Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 65 NEW YORK, SATURDAY, MAY 22, 1915 No. 21

The Right of Appeal

ONE effect of the decisions of the New Hampshire Supreme Court in the Grafton County Electric Light & Power Company case appears to be to confirm and strengthen clear rights of appeal from orders of the Public Service Commission. It is desirable in every way that the right of appeal to the courts from findings of the commissions shall be plain and unequivocal. This is in the interest of the companies as well as of the public. If the policies of the commissions are not in accord with their legal powers but are otherwise just and they feel that the public interest requires that they have greater authority, they must seek the remedy in new laws; but the commissions may easily do injustice without infraction of law. Temporarily commissions may be strengthened by the exercise of sweeping powers when the right of appeal is limited narrowly; but if the enhancement of commission authority is at the expense of a fair public attitude and policy, it will not continue. The right of appeal should not be so limited as to harass a company or, on the other hand, to permit the nullification of fair orders or cause regulation to become a farce.

Determination of Coil Losses

FOR measuring the apparent resistance and reactance of windings at different frequencies various methods are available, according to the range of frequency and power to be covered in the tests. When the power used in the testing circuit is large wattmeter methods are commonly resorted to. On the other hand, when the power employed is small a balancing or null method may advantageously be employed. Among the null methods available are the Rayleigh-bridge and the differential-indicator methods. In his article on page 1300, Dr. August Hund describes a particular form of differential null method, utilizing a differential induction coil having two opposing primary coils and a secondary coil connected to the alternating-current detector. Among such detectors, the telephone has the advantage of convenience and sensibility, although an absolute zero of sound in it is often very difficult to secure. If the winding under test has an iron core, hyteresis and eddy currents in the core give rise in the telephone circuit to upper harmonics that are hard either to compensate or to ignore. The expedient is suggested of employing a condenser in series with the indicating telephone in such a case, tuning the telephone circuit by adjusting the condenser until resonance is obtained to the primary fundamental frequency. Under these conditions the receptiveness of the telephone to that frequency is increased, while to higher harmonic frequencies it is diminished. Although such an expedient may not be new, it is well worth remembering. With a vibration galvanometer this precaution is hardly necessary since its indicating system is already mechanically tuned to the fundamental frequency; but the necessity of retuning such a galvanometer to each new impressed frequency constitutes a great drawback to the use of that instrument.

Informal N. E. L. A. Discussions

BECAUSE of the conditions in the electrical industry during the last ten months the convention of the National Electric Light Association to be held in San Francisco on June 7 to 11 has a particular interest for those who will attend. Probably no central-station company has been entirely unaffected by the war. Either financial arrangements or business conditions have been altered in substantially every locality. That the main result is merely a reduction in the rate of increase in business is a gratifying fact, of which the central-station industry cannot fail to take notice in the convention. While, as usual, the regular problems of construction, operation and management comprise the formal part of the program, much informal discussion of means employed to maintain stability in earnings will take place. This will be one of the most valuable features of the convention, yet it will be largely in the unwritten history. Those who make the journey will be doubly repaid by the closer contact which they will get with the uncommon problems that have been before executives almost continually since the 1914 convention.

Selling Securities to Consumers

THE suggestion at a meeting of officials of the Northern States Power Company that means be considered for placing securities of the company with consumers follows the successful development of a market of this character by the Pacific Gas & Electric Company last year. The strong banking position in the territory served by the Northern States company encourages efforts of this kind, which have two advantages for central-station properties. First, they mean closer relations with consumers and a co-operative interest in the welfare and integrity of the company; second, if successful, they assure a saving in the cost of selling securities. If a company develops a market for its securities among its own consumers, its financing costs are likely to be substantially lower than if it pays the banker's cost of organization and selling and a profit which compensates him for acting as interme-

diary. However, the central-station company which sells its obligations or stock directly to consumers accepts a new responsibility in that relationship which it cannot wisely regard as a light one.

Problems of a Large Steam Station

In the consolidation of the electrical properties around Pittsburgh the ultimate result was, as it nearly always is, the building of a generating station capable of dealing with the whole electric supply of the district, which in this instance includes a population of practically 1,000,000 people. The main station is not wholly a new one, but represents the reconstruction and enlargement of the generating station on Brunots Island originally established by the Pittsburgh Railways Company. This site, 3 miles below the junction of the Allegheny and Monongahela Rivers, is particularly adapted for generation of energy at low cost, while the existing station was of a character which permitted effective enlargement. Results have proved that good judgment was exercised in the choice of the site since the increase in output rating has been secured for about 60 per cent of the cost of a complete new station.

In a great steam station such as this one of the fundamental requisites is ease of fuel supply. In this case the coal is usually brought in on barges and discharged at a crusher house, whence it is distributed to the different coal bins, from which it passes to the automatic stokers. The railway tracks and sidings being about 50 ft. above the level of the yard, fuel brought by rail can easily be dumped directly from the cars into the plant. The fuel dock is equipped with an electric coal hoist capable of handling 200 tons an hour and with a 4-ton grab bucket for unloading the barges as they come in. Whether brought by water or rail, the coal is automatically weighed and recorded before going to the crusher house, and by a very complete automatic equipment the fuel can be discharged at any point in the bunkers which may be necessary.

In the design of the energy-distributing system some considerable problems demanded solution. Wherever large generators are operated in parallel the dangers of short-circuits in the cables are grave and a very heavy responsibility is put upon the switching devices. In fact, to save the apparatus in case of a short-circuit it is apparently necessary to provide for each generator switches or circuit-breakers big enough to take care of the entire station capacity. This implies almost impracticably large and expensive apparatus. The danger points are in the generator bus system and the generator cable leads to the switchboard. In this instance the requirements were so severe that it was decided to place ample reactance coils between each of the bus sections to prevent the whole system feeding energy back into an injured section. The coils were so proportioned that the drop in voltage produced by a short-circuit in one section will be insufficient to throw out of step synchronous apparatus on the other sections. To avoid inconveniently large difference of voltage on adjacent sections in case of accidents the reactance coils are shunted by circuit-breakers set for instantaneous operation so that the shunt will open before any synchronous apparatus would have time to drop out of step. The protective system has been found to work successfully when put to test through accident. This contribution to the solution of a very difficult problem in switchboard design deserves careful attention, since the larger the station the worse, under ordinary circumstances, is the situation as respects short-circuits.

Cost of Operating Electric Vehicles

In this issue of the ELECTRICAL WORLD are presented the results of our undertaking to determine the cost at which electric vehicles are being operated. Many months of persistent effort have been required to secure from those who were in possession of the information desired the co-operation essential for obtaining the data. It was necessary to proceed in such a manner that the co-operation desired was reduced to the comparison of an expert analysis of what the operating cost should be with the actual bookkeeping records of the owner. A set of base-line figures, so to speak, were established for the daily operating cost of each size of machine, and upon comparison with the actual records of cost a statement of the record's deviation from these base figures was received whenever such deviation existed. The base figures were purposely made 5 per cent high, and hence most of the verifications received indicate that the equipments investigated are being operated at a small percentage below the base figures. The costs recorded in the table may therefore be regarded as the maximum for normal service.

The investigation, which has been carried further than any other in this field of research, should prove beneficial to all who are in any way interested in the use of electric vehicles. By comparing his costs with those of other users of similar equipment the vehicle owner will be able to ascertain whether he is operating for the least cost, or whether there is room for improvement in this direction. The compilation supplies the manufacturer with evidence which it would be difficult to secure in any other way. Much information has long been available concerning the cost of vehicle operation in certain services, but we believe that this is the first time the matter has been developed upon so broad a scale and upon such a uniform basis as to make the data readily available for general employment.

It is particularly fortunate that the information shown by the compilation can be presented at this time for the benefit of those large central-station organizations which have been giving consideration to ways and means for exploiting the electric vehicle to produce an "off-peak" load of some magnitude. One of the essentials to any consideration of this kind is reliable information relative to the cost at which electric vehicles can be operated or what the present owners are paying for the use of such equipment. In this connection it may be pointed out that a glance at the list of the users of

the vehicle equipments investigated will show the conservative and substantial character of the organizations now using electric vehicles. The large amounts of money they have been willing to invest are also made evident, as are their annual outlay for operation and the relation of this outlay to the investment. Another significant piece of evidence will be found in contrasting the relative costs of operating the various sizes of machines, in order to determine which size shall be used or offered for service under any given set of conditions. These are merely a few of the many obvious lessons which a central-station executive may draw from the results of the investigation herein recorded.

Instructions in Illuminating Engineering

In most branches of engineering the practice of the art is the work of a specialized few. In military or in civil engineering, for instance, the execution of designs is ordinarily in charge of engineers and their assistants. Illuminating engineering, however, constitutes an exception to this rule, in the sense that the lighting of the homes is ordinarily left to the care of the householders. Large buildings and extensive illuminations should indeed be intrusted to illuminating engineers, as specialists in effectiveness, decorativeness and economy of lighting, but the vast majority of the artificial lighting of the world must needs be accomplished by the non-expert hands of the multitudinous public. It is therefore more important, as regards illumination, than in perhaps any other branch of engineering that a knowledge of the salient features of good lighting, in regard to health and hygiene, should be disseminated among the people.

It is in this respect that the educational work of the Illuminating Engineering Society is more directly in touch with the average man and woman than is the corresponding work of the other national engineering societies. The latter help train men for ministering to public needs. The former can help the public to minister in some degree to its own needs. It is not too much to expect that the public should be able to recognize good lighting in halls and theaters, or should be able to avoid injurious home lighting. The primer issued by the Illuminating Engineering Society serves to give general information on these points.

In a paper on "Illuminating Engineering as a Branch of Technical Instruction" recently read before the New York Section of the I. E. S., Prof. C. E. Clewell emphasized the importance of promoting a knowledge of illuminating engineering principles, both generally and specifically. In the general field a better appreciation of good lighting can be fostered in the public not only by attention to detail on the part of illuminating engineers but also by organizing lecture tours and exhibitions to bring to public notice and attention illustrations of good and bad illumination. In the specific field of illuminating engineering college courses can be organized for giving special instruction in the scientific and esthetic principles of illumination.

There can be little doubt that the history of the past will be extended into the future in regard to the development of engineering specialization. That is to say, not only must the fundamental mechanics, mathematics, physics and chemistry underlying all engineering continue to be taught to all college students of engineering, but also the more detailed applications of those sciences to particular branches will have to be taught, so that engineering specialties will have to be maintained. Only a few decades ago only one type of engineering was taught in the non-military colleges, namely, civil engineering. To-day civil, mechanical, electrical and mining engineering are taught as specialties. Before long we shall probably have to maintain as many more, including illuminating engineering. It will not be practicable for each and all of the engineering colleges to maintain each and all of the increasing number of specialties. It seems likely that particular engineering colleges will develop particular specialties, a tendency already visible, and possessing distinct advantages, if not carried too far.

A High-Head Plant in New England

In a brief article in the current issue is described the plant of the Pittsford Power Company—a 6000-hp hydroelectric plant operating under a head of 480 ft. among the New England hills—the existence of which bears striking evidence to a topographical fact not particularly well known. Along the southern part of the Green Mountains the peaks themselves spring in general out of a high plateau well raised above the Lake Champlain basin on the west and the slopes toward the Connecticut valley on the east. The western face of the plateau is somewhat abrupt. Moreover, the rainfall over the Green Mountain plateau is exceptionally large; in fact, it is among the largest to be found in the United States, although materially less than that which characterizes a small region in the Southern Appalachian Mountains and another in the Northern Coast range. In connection with the storage reservoir of about 1,000,000 cu. ft. previously used for holding back the water for a plant below, the new plant puts to good service the 480-ft. head between the upper and lower reservoirs.

An exceptional feature of the plant resides in the use of regular turbines of the Francis type instead of impulse wheels. The head is such as would ordinarily be utilized through Pelton wheels on the Pacific Coast, where such heads are common, but impulse wheels at such heads are not so simple as at higher heads, requiring as they do multiple wheels and multiple nozzles for developing the 2000 hp demanded for each of the units in this plant. It would be interesting to determine, as could easily be done by means of the recording water meter installed in the plant for showing continuously the amount of water used in the turbines, the efficiency of the wheels as compared with those of the impulse type. The head utilized is somewhere near the dividing line between impulse wheels and turbines, where comparative data will prove highly valuable.

LETTERS TO THE EDITOR

Criteria of Commutation

To the Editor of the ELECTRICAL WORLD:

SIR:—I am glad to be set straight by Mr. F. W. Carter's letter in your issue dated April 24 on the subject of commutation, and acknowledge his priority in proposing the formula $2RT > L$ and in showing that a finite current density is a poor criterion. However, he does not point out, as was done in my article, that this formula agrees with Hobart's formula. It was farthest from my intention (not being a professional designer) to set up a new formula for commutation.

It was my purpose to call attention to the fact that Arnold's theoretical formula and Hobart's empirical formula were at odds, and that this disagreement was overcome by improvement in the physical criterion. In my article I attributed Mr. Carter's physical criterion (finite watts at edge of brush) to Arnold and LaCour on the authority of Hawkins and Wallis, and admitted it to be superior to finite current density. I may be pardoned, I hope, for still preferring finite temperature as a criterion. It is indeed curious to learn that two criteria so different should lead to the same result.

I regret to have to call attention to an error in equation 12 of my article in your issue of March 6, 1915. The last two inequalities should read $(m\text{-}1)/m$ in place of m.

Ames, Ia. JOHN F. H. DOUGLAS.

What Does the User of a Small Motor Require?

To the Editor of the ELECTRICAL WORLD:

SIR:—The average man who buys a small motor expects that it will be easy to put in place and that he will never have to give it attention afterward except to throw the switch. So far as the latter requirement is concerned, his wish is complied with, though there is always the possibility of better service if some attention be paid to cleanliness. Once in place an induction motor is as immune from accidents as is any piece of machinery. Motors having a commutator will always be shunned by those who are not familiar with electrical machinery, even though their advantages may seem to the electrical engineer to outweigh their drawbacks. That this is true can be seen from the very considerable expense to which builders and users of individually driven machines will go to provide mechanical means for speed changing rather than use motors with commutators. In this respect the manufacturers are meeting the demands of the public, but as regards ease of installation they are not.

The prevailing type of motor, as nearly spherical as possible, is good so far as looks and probably so far as electrical efficiency go, but it is about as hard to handle as any motor that could be invented. To be sure, every manufacturer provides the time-honored eye-bolt with which to hoist it, and this would be all-sufficient if motors were always installed right side up and with an abundance of head room over them. The manufacturers make the bearings in such a way that they can be mounted with any one of four sides up. The user very often takes advantage of this opportunity, and installs the motor on the wall or on the ceiling, in which case there is nothing to get hold of.

As a result of experience with motors mounted in this way, it has become the usual practice to place the machines on brackets or on platforms low enough from the ceiling to permit a hoist to be hung from above to swing them into place. A platform built low enough for that purpose is in the way; it cuts off the light and has a very objectionable appearance. It also causes the belts to be lower than the line shaft in many cases. The same is true of a wall bracket.

Manufacturers who wish to be more considerate of their customers should furnish a motor the outer surface of which forms practically the sides of a cube. Such a motor could be mounted on skids any side up and jacked into place within a few inches of the ceiling, thereby doing away with the necessity of using either a platform or a bracket. In the rare cases when it is necessary to remove the armature it is easier to erect some "horses" and a temporary staging than it is to use the platform, and hence no disadvantage will be found even when repairs are necessary. Such a cubical motor might not appeal to the esthetic soul of the designer, but the platform which it would do away with is not especially artistic, nor does it serve any useful purpose except to reduce the amount of profanity necessary in installing the round type which alone we can buy now.

Boston, Mass. E. F. HENRY.

The Western Union Multiplex Printing Telegraph

To the Editor of the ELECTRICAL WORLD:

SIR:—In an editorial in your issue dated April 3, 1915, you were good enough to mention the fact that the Murray multiplex printing telegraph had been incorporated in the Western Union multiplex page-printing system. In the description of the Western Union system in the same issue the statement is made that that system is the result of "the combined effort and experience of the engineers" of the Western Union and Western Electric companies, not a word being said about my very considerable share in the matter.

I believe that the Western Union multiplex system and its European twin brother, the Murray multiplex, are so important from a telegraphic point of view that their origin and development will in time have some historical interest for telegraph men. I must therefore ask you to be good enough to mention the following facts:

At the beginning of 1912 I sold my United States patent rights in the Murray multiplex printing telegraph to the Western Union Telegraph Company for a substantial sum. As soon as the purchase was decided upon by the officers of that company, the Western Union and Western Electric engineers started collaborating on the work of development along the lines recommended by me. With the single exception of the printer, the Western Union multiplex system has been based substantially on the lines I recommended, and it embodies numerous inventive features due to me. The printer alone is due solely to the Western Electric Company, and that is the only important feature of the Western Union multiplex in which I did not have any share.

The bedrock foundation of any printing telegraph system consists of two things—(1) the code or alphabet employed, and (2) the method of synchronism. Forty years ago Baudot had applied the five-unit code with success to his multiplex printing telegraph, but the importance of the five-unit alphabet was not generally recognized until I gave prominence to it and explained its advantages in my paper on "Setting Type by Telegraph," read before the (British) Institution of

Electrical Engineers in London in 1905. Following the example of Baudot, I had adopted the five-unit alphabet with success in the Murray automatic printing telegraph, and I also, of course, used it with the Murray multiplex system. Since then the Siemens & Halske company has had to change over to the five-unit alphabet for the Siemens automatic printing telegraph. The Morkrum company adopted the five-unit alphabet, so Mr. Krum informed me, as the direct result of reading my paper of 1905. The Wright system was compelled to adopt it, and the Western Union, in taking over my United States multiplex rights, not only adopted the five-unit alphabet but also adopted my arrangement of the letters and numerals and operation signals. My arrangement is quite different from the Baudot arrangement. I allocated the letters so that the most frequently used were represented by the fewest holes in the paper tape. That means stronger tape and less wear on the punching mechanism. Baudot used the five positive unit combination (ooooo in the tape) to represent "P." I allotted "P" to the combination .oo.o so as to leave ooooo available for invisible correction of errors in the tape. The Western Union adopted my arrangement, with the one exception of the punctuation marks, which have been altered to suit American requirements; and yet anyone reading Mr. Rainey's description in your issue of April 3, 1915, would believe that the code used by the Western Union was the Baudot arrangement, whereas it is mine.

The second fundamental feature, the method of synchronism, is also due to me, although various changes in the mechanical design have been made in it by the Western Union and Western Electric engineers. On my recommendation the Western Union started the development work by purchasing two Baudot distributers. I had recommended the application of the phonic motor and vibrator drive to the Baudot distributers with the Baudot method of "shift-the-hands" correction, and it was specifically mentioned in the Western Union agreement with me that I was to patent this combination for the Western Union in the United States. Distributers are *clocks*, and the new combination I recommended embodied the vitally important principles of "shift-the-hands" correction of phase and resonant control (pendulum or vibrator control) of speed. The Western Union engineers apparently did not recognize its importance, and they struggled along at thirty words a minute with the Baudot distributers for more than a year. A day or two after my return visit to New York in 1914 the Western Union engineers applied to their Baudot distributers two phonic motors and vibrators that they had purchased from me in 1912, and forthwith all synchronism troubles disappeared and they had no difficulty in raising the speed to from forty to forty-five words a minute. The Western Union engineers have since added to this arrangement mechanism for correction of synchronism from the signals themselves on lines practically identical with those employed for some years past on the Baudot multiplex system between Marseilles and Algiers, a description of which is given in Caminade's book on the Baudot system. My clock method of synchronism, however, remains the fundamental feature.

In 1912, when the Western Union Telegraph Company bought my American patent rights, I recommended the adoption of cross-perforated tape with my arrangement of the five-unit alphabet, and I explained the general design of a suitable keyboard perforator and transmitter. The Western Union engineers adopted my recommendations, and the Western Union keyboard perforator and transmitter made by the Western Electric Company follow substantially the general lines that I recommended. They include also the back-spacing key feature of the Murray multiplex, with its provision for instant and invisible correction of errors in the tape. The engineers adopted my manual start and stop for the transmitter, and after I had repeatedly pointed out the importance of the automatic start and stop for the transmitter they adopted that feature also.

I mentioned in 1912 the advantage in certain cases of using locking local relays for the printer, and I gave the Western Union engineers a blueprint of the arrangement. It was an old device, but I do not remember having seen it applied to a multiplex printing telegraph before. That recommendation is also embodied in the Western Union multiplex, and when I was in New York in 1914 I was informed that it was an important element in the success of the system.

Among other apparatus that I sold to the Western Union in 1912 was a receiving tape perforator for perforating tape at the receiving end of the telegraph line simultaneously with the printing of the message in page form directly from the line signals, and with it I explained how to provide for switching this reperforator into or out of action by signals from the distant sending station. Briefly, the machine was a keyboard perforator with five small magnets substituted for the keyboard. The Western Union receiving perforator is of substantially the same design modified to produce cross-perforated tape.

I have recommended several other features to the Western Union Telegraph Company which may or may not be adopted, among them being an automatic cut page feed making use of the ordinary cut printed telegraph blanks.

In setting forth these facts I do not in any way wish to belittle the work of the Western Union and Western Electric engineers. They have done a great deal of excellent detail development work on the multiplex and have put it into excellent shape for Western Union requirements. I have done the same with the Murray multiplex in Europe, my line of development having been chiefly in the direction of meeting the requirements of administrations using the Baudot multiplex, of which there are more than 400 circuits in use in various parts of the world. All I am asking is that my very considerable share in the development of the Western Union multiplex shall receive due acknowledgment.

London, England. DONALD MURRAY.

Initial Current Rush of Tungsten-Lamp Loads

To the Editor of the ELECTRICAL WORLD:

SIR:—In the letter written by Mr. Evan J. Edwards, appearing on page 1001 of your issue of May 1, the statement is made that the initial rush of current to cold tungsten lamps, while very severe, is so brief that it will not blow a fuse or trip a time-controlled circuit-breaker.

Quite a number of times in the memory of the writer a transformer supplying a load composed entirely of tungsten lamps, upon being transferred from one circuit to another, has blown its primary fuses. In each case the circuit was perfectly clear, had been operating without trouble for weeks, and continued to operate, when service was finally resumed, without any trouble developing. It is reasonable to suppose that the initial rush of current caused the blowing of these fuses; in fact, this seems to be the only satisfactory explanation.

If anyone has information on this subject or is able to offer any more satisfactory explanation for the blowing of these fuses, I shall be glad to hear from him.

D. C. BLACK,

Pittsburgh, Pa. *Duquesne Light Company.*

Presentations of Franklin Medal

At a stated meeting of the Franklin Institute of Philadelphia on the evening of May 19 the Franklin Medal was awarded to Mr. Thomas A. Edison and to Dr. Heike Kamerlingh Onnes, director of the physical laboratory of the University of Leiden, Holland. Mr. Edison was present in person to receive the medal. Chevalier van Rappard, Minister from the Netherlands government, received the medal on behalf of Professor Onnes. Mr. Walton Clark, president of the institute, presided and many men eminent in the electrical industry went from different parts of the country to attend the proceedings. Dr. Harry F. Keller of the institute made the introductory address.

The Franklin Medal is the highest recognition in the gift of the Franklin Institute. The awards were made on the recommendation of the committee on science and the arts of the institute, that to Onnes being in recog-

OBVERSE AND REVERSE OF FRANKLIN MEDAL

nition of his "long-continued and indefatigable labors in low-temperature research, which have enriched physical science not only with a great number of new methods and ingenious devices but also with achievements and discoveries of the first magnitude," and that to Edison in recognition of "the value of numerous basic inventions and discoveries forming the foundation of world-wide industries, signally contributing to the well-being, comfort and pleasure of the human race."

The sculptor's model of the Franklin Medal was presented at the meeting to Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, by whom the Franklin Medal fund was founded on Jan. 1, 1914. The awards to Mr. Edison and Professor Onnes are the first to be made.

After the presentations an address was made by Mr. Insull on "Electricity and Modern Industrial Growth." Mr. Insull discussed the amazing development of the electrical industry and its profound influence on all activities of the world.

The Edison Medal to Dr. Bell

The Edison Medal "for meritorious achievement in electrical science" was conferred upon Dr. Alexander Graham Bell, inventor of the telephone, at the annual meeting of the American Institute of Electrical Engineers, New York City, May 18. The presentation address was made by Mr. J. J. Carty, president-elect of the Institute and chief engineer of the American Telephone & Telegraph Company. Dr. Schuyler Skaats Wheeler, chairman of the Edison Medal committee, presided at the ceremony and recounted how the Edison Medal was founded by old associates and friends of Mr. Thomas A. Edison, the award being made annually by a committee of twenty-four members of the A. I. E. E. Mr. Thomas A. Watson, of East Braintree, Mass., Dr. Bell's associate in the early work on the telephone, and later founder and president of the Fore River Ship Building Company, opened the program with an address on "How Bell Invented the Telephone."

In responding to Mr. Carty's presentation address and to the ovation which punctuated it, Dr. Bell hinted that electrical transmission may not stop at the conveyance of speech, but that some future inventor may yet discover means for seeing by wire, or for even the telegraphic transmission of thought between persons widely separated but having their heads inclosed in connected coils of wire. Dr. Bell also called attention to the existence of great gaps in the range of vibration between frequencies which the human senses recognize as sound and those appreciable as heat, and declared that in these gaps lie tremendous opportunities for investigation and for electrical experimentation which may lead to still greater achievements in the transmission of intelligence.

Annual Report of Westinghouse Electric & Manufacturing Company

Sales billed by the Westinghouse Electric & Manufacturing Company during the fiscal year ended March 31, 1915, amounted to $33,671,485, as compared with $43,733,646 in the previous year. The cost of sales was $31,109,073, as compared with $39,016,424 in the preceding year. The net manufacturing profit was $2,562,412, against $4,717,222 in the fiscal year ended March 31, 1914. The value of unfilled orders on March 31, 1915, was $8,951,410, as compared with $7,951,385 at the close of the previous year. The income account for the last year is shown in the accompanying statement:

Gross earnings:		
Sales billed		$33,671,485
Cost of sales:		
Factory cost, including all expenditures for patterns, dies, new small tools and other betterments and extensions; also depreciations of property and plant, inventory adjustments and all selling, administration, general and development expenses		31,109,073
Net manufacturing profit		$2,562,412
Other income:		
Interest and discount	$447,178	
Dividends and interest on sundry stocks and bonds owned	686,239	
Miscellaneous—Royalties, etc.	25,110	1,158,527
Gross income from all sources		$3,720,939
Deductions from income:		
Interest on bonds and debentures	$1,023,801	
Interest on collateral notes	200,866	
Interest on long-term notes and mortgages	44,251	
Proportion of expenses incident to note and bond issues	85,208	
Miscellaneous and extraordinary expenses	357,069	1,711,195
Net income available for dividends and other purposes		$2,009,744

To the profit and loss surplus of $7,659,130 as of March 31, 1914, $82,553 from miscellaneous sources was added, making a total of $7,741,683. Added to the net income of $2,009,744 from the operations of the year, this made a total of $9,751,427. Dividends on the preferred stock aggregated $279,909 and on the common stock $1,427,350; net charges for depreciations and adjustments were $444,499, and miscellaneous deductions aggregated $126,258, or a total charge against the surplus of $2,278,016. The balance sheet surplus as of March 31, 1915, was $7,473,411. Cash on hand at the close of the fiscal year was $8,980,390, against $6,343,733 one year earlier.

Mr. Guy E. Tripp, chairman of the board of directors, in commenting on the business of the year, says that the large reduction in sales billed as compared with the previous year is due chiefly to the unfavorable business conditions during the period, but partly to the fact that

from June 5 to July 13, 1914, the main works at East Pittsburgh, Pa., were practically closed by a strike of operatives. The reduction in sales billed largely accounts for the reduction in the net income, but it was also affected by conditions due to the strike. All of the extraordinary expenses caused by the strike, as well as the factory and general expenses during the strike, were charged against the income for the year.

During the current year the expenditures for new equipment and for extensions to buildings, resulting in an increase of 65,500 sq. ft. in manufacturing floor space, were exceeded by the depreciation charges, so that the property and plant account again shows a decrease from the figures of the preceding year. Property and plant stood on March 31, 1915, at $19,882,870, as compared with the valuation of $20,054,595 one year previous.

Another change in the asset accounts that receives special comment from Mr. Tripp is that pertaining to investments. Investments were $17,683,094, as compared with $18,827,432 on March 31, 1914. Discussing the changes, Mr. Tripp says:

"After a careful examination and appraisal of the assets of the Westinghouse Machine Company, your directors authorized an offer to stockholders of that company to exchange their holdings for the common stock of the Westinghouse Electric & Manufacturing Company, on the basis of one share of the latter for three shares of the Machine company. More than 85 per cent of the issued capital stock of the Westinghouse Machine Company was so exchanged. This transaction almost wholly accounts for the increase in your investment in subsidiary and allied companies in the United States.

"The main plant of the Machine company adjoins the main plants of your company at East Pittsburgh, Pa., and it also owns a large foundry at Trafford City, near East Pittsburgh, and a plant at Attica, N. Y. The main products of the Machine company are sold chiefly in conjunction with the products of your company. Your directors believe that the ownership of this large controlling interest in the capital stock of the Westinghouse Machine Company will prove of advantage to your company.

"Your investments in the capital stocks of the Société Anonyme Westinghouse (French company) were sold during the year to the British Westinghouse Electric & Manufacturing Company, Ltd. Payment was received in the form of other securities on a basis that your directors believe will be beneficial to your company. The British company now owns the controlling interest in the French company, and through the latter the controlling interest in the Italian company.

"The war in Europe has delayed the completion of the liquidation of the Russian company, but much the larger proportion of the amount estimated to be received from the liquidation has already been remitted to your company."

The increase in cash balances and decreases in accounts and notes receivable and inventories reflect the decrease in the volume of business. A further large reduction in the indebtedness of the company was effected during the year. Two issues of collateral notes aggregating $4,500,000 were paid off from the proceeds of the sale of securities, chiefly of the Scranton & Wilkes-Barre Traction Corporation.

Mr. Tripp says that a number of unusual conditions arising during the year called for the exercise of special effort on the part of the officers and employees of the company, and the board of directors acknowledges its appreciation of their loyal co-operation and of the efficient manner in which these conditions were met. During the year the company inaugurated a service-pension system. The average number of employees during the year was 15,145, as compared with an average of 18,635 in the previous year.

The Loss of Dr. Pearson

BY HOWARD P. QUICK, DESIGNING AND MECHANICAL ENGINEER, PEARSON ENGINEERING CORPORATION, LTD.

With the sinking of the *Lusitania* there was lost a man whose name has been known among engineers and financiers the world over for twenty-five years as a matchless technical and financial director of great engineering enterprises. That man was F. S. Pearson, D.Sc., slain in the prime of life by the cruel agency of a German submarine. His loss is all the more strangely fateful for the Germans, for many firms in that country have had huge orders from his enterprises and more would naturally follow.

Dr. Pearson was a man who shunned publicity, although many times it was forced on him by well-meaning friends and once or twice by ill-advised alliances. Consequently he was not so well known as some less successful men nor were his great benefactions to the people of several foreign countries or his personal characteristics so much talked about as some of his spectacular projects. It is safe to say that his enterprises, principally public utilities—electrical, gas, telephone and railway—benefit immeasurably a combined total of 5,000,000 people, equal to the population of New York, composed mostly of Spanish, Brazilians and Mexicans, and have brought them the comforts of modern life.

Where lesser men failed to do more than scratch at the surface, he stepped in, saw possibilities, predicted the success of acquirement, consolidation, development and operation under American management and by American ways, won the confidence of the bankers of several countries, raised the funds and, notwithstanding the handicap of a foreign language and great distance from the source of supplies and engineering direction, found the experts to do the things properly and succeeded in establishing, at the cost of hundreds of millions of dollars, business enterprises thoroughly sound at the core and, except under war or revolutionary conditions, paying propositions. Such are the Sao Paulo Tramway, Light & Power Company, the Rio de Janeiro Tramway, Light & Power Company, the Sao Paulo Electric Company, all now merged with various gas and telephone companies into one great company, the Brazilian Traction, Light & Power Company; the companies in and around Mexico City and those in and around Barcelona, Spain; the great electric companies in Niagara Falls and Toronto, Ont.; the Winnipeg (Man.) companies, and the railroad, milling and mining companies in northwestern Mexico. These companies possess 2,000,000 acres of white-pine timber land, own mines of steam coal and operate scenic railroads and lumber-manufacturing plants, have the greatest combination of public utilities and the largest cities in the world wholly electrified from waterfalls.

Dr. Pearson was an American, but lately, owing to the necessity of being near the financial centers of London, Paris and Brussels, had lived largely abroad. He was a self-made man, but had such a thorough grounding in chemistry and electricity and such courage, inventiveness and foresightedness that early in his career he inspired confidence in great financiers and owners of street-railway properties, when the art was in its infancy, in the belief that electric railways could be made to pay. He was ahead of the manufacturers in all his demands, and many of the great engine, generator and motor companies owe their early development and expansion to him. In the electrifica-

tion of the Boston, Brooklyn and New York street railways he was the great dynamic force that overcame obstacles, built great generating plants and electric systems of transit, and set the pace and standards for the world.

Dr. Pearson was so full of energy, so rapid in his thoughts and calculations, so masterful in combination and in the development of the natural resources of the earth that he early sought the field of foreign countries where a freer hand was given to him to do anything he pleased, which was always for the immediate and lasting benefit of the people and ultimately for the stockholders. He inspired confidence in foreigners of many nations, got wonderful concessions, and cheapened the cost of fuel, light and energy greatly wherever he went. The coming of his companies into great foreign cities brightened the dark spots, induced cleanliness and sanitation, and resulted in better water supply and sewerage systems. To him nothing was formidable. The highest waterfalls in the most inaccessible regions were his by the magic of his organization, push and "get there" qualities. Mountains were eaten away, tunnels bored, precipices scaled with ease wherever he chose to go. Canadian capital was the first to invest in his enterprises, but later English, French and Belgian men furnished much of the money, and Dr. Pearson himself became a millionaire and large owner in all the companies. At the time of his death he was president or chairman of the board of directors as well as consulting engineer of a dozen large companies and many small companies.

Dr. Pearson became a thorough master of every subject he attacked, whether engineering, financing, music, art or farming. He was only fifty-four years old, yet had compressed a whole lifetime of achievement into the last twenty-five years. Evidently his work was done and was to be passed on to others. The effect on Dr. Pearson's companies of the revolution in Mexico and the great war in Europe, cutting off as they did all sources of funds for new development, was very great. His resourcefulness may best be illustrated by the fact that he overcame the difficulties of exchange with Brazil and meeting of liabilities for purchases and payment of dividends by buying shiploads of coffee in Brazilian money and selling them to New York or Europe for dollars and sterling, and used the same ships to transport back to Brazil coal, machinery and merchandise for the various companies which needed them.

Dr. Pearson gathered around him a great number of strong, competent, dependable men, engineers, managers, superintendents and experts in various lines, who are using foreign tongues in operating his properties and doing it successfully under great difficulties, and they and their families will miss his guiding and helping hand.

He was a continuous reader in all lines of thought and practice. His travels by sea and land, day and night, were so extensive that few could keep his pace, yet he was constantly in touch by telegraph with the staffs of all his offices and companies and settled great financial and technical questions with the data which he always kept at his fingers' ends.

Dr. Pearson's alma mater, Tufts College, is greatly indebted to him, as are many societies and individuals, and his place can never be filled. His enterprises will live, however, and benefit unnumbered generations to come, and will extend along the lines already shown to be so correct in principle and practice. It is to be regretted that many great communities which sought his advice will never see the fruition of plans which he had for their development. Many of these were postponed by the great war, which has now taken the great engineer.

Litigation Over Radiotelegraphy Patents

Judges Lacombe, Ward and Rogers, of the United States Circuit Court of Appeals for the Second District, affirmed *pro curiam* on May 13 the preliminary injunction order issued last November by Judge Hough, of the United States District Court for the Southern District of New York, restraining the De Forest Radio Telephone & Telegraph Company, the Standard Oil Company of New York, and Dr. Lee de Forest from further infringing patents of Marconi and Lodge owned by the Marconi Wireless Telegraph Company of America. The Court of Appeals decision held that the injunction had been issued properly in view of the results in the prior litigation under the same patents.

The patents in question, which were sustained by Judge Veeder last year and are now in litigation against the Atlantic Communication Company, cover broadly the use of inductance coils for tuning and increasing persistence of oscillations in a wireless-telegraph antenna (Lodge, No. 609,154) and the tuning together of closed and open oscillation circuits at the sender and receiver (Marconi, No. 763,772).

The de Forest company contested the claim of infringement, urging that special "condenser coupled" circuits which had been developed by their experts, Messrs. John Stone Stone and Lee de Forest, were not in fact like those of the patents in suit. The defendants also contended that the Marconi company charged excessively high rental rates for wireless-telegraph instruments. Judge Hough found infringement, however, and stated in his opinion that the rental charges were not exorbitant since the Marconi company was entitled to receive a fair return from the inventions involved, which were "of the greatest value and worthy both of praise and reward." The injunction was therefore issued, but an immediate appeal was taken by the defendants.

It is possible that there will be no hearing on the merits of the case against the de Forest company until the termination of the parallel action against the Telefunken (Atlantic Communication) Company, and that the preliminary injunction which now stands will either be made permanent or removed according to the outcome of this litigation in the Eastern District Court.

Northern States Power Company Managers Meet

Mr. Otto E. Osthoff, vice-president of H. M. Byllesby & Company, called recently a meeting of division managers of the Northern States Power Company, controlling operating properties in forty cities in Minnesota, the Dakotas, Wisconsin and Illinois. Bond men from the Chicago and New York offices of the Byllesby organization were also present. It was Mr. Osthoff's idea to bring the men together to devise ways and means of placing securities of the Northern States Power Company not only with banks and investors in the districts served but also with consumers. The suggestion was received with enthusiasm, and many managers told of inquiries concerning the company's securities.

Mr. Osthoff also discussed a number of central-station problems, such as maintenance and depreciation. He quoted statistics showing the increase of the company's connected load during the year ended Jan. 31, some of these being as follows: Electric customers, 18.4 per cent; motor load, 14.7 per cent; lighting load, 21.7 per cent; total kilowatts connected for all purposes, 18.9 per cent.

The delegates made an inspection trip to the Coon Rapids hydroelectric plant on the Mississippi River near Minneapolis.

The Brunots Island Generating Station

Main Power House of the Duquesne Light Company of Pittsburgh, Pa., Serving a Population of 1,000,000

BY F. UHLENHAUT, JR., CHIEF ENGINEER DUQUESNE LIGHT COMPANY

THE principal generating station of the Duquesne Light Company of Pittsburgh is situated on Brunots Island, in the Ohio River, 3 miles below the junction of the Allegheny and the Monongahela Rivers at what is known as "The Point"—the site of the famous old Block House, still standing, which was established in 1758 by the English as Fort Pitt and from which the city derived its name. This station also furnishes energy to the Pittsburgh Railways Company for the operation of its city and suburban lines.

The Duquesne Light Company supplies electric energy to the Pittsburgh district, embracing the entire portion of Allegheny County adjacent to the rivers above mentioned. The territory covered includes a population of nearly 1,000,000, concentrated principally in the valleys along the rivers forming the heart of the coal and iron industry.

When the company was reorganized a few years ago, it took over all the generating stations previously operated by the Allegheny County Light Company, the Pittsburgh Railways Company and the old Duquesne Light Company. Some of these stations were small and relatively inefficient, and it was seen that if the new scheme was to effect the economies which were part of the reorganization plan, more up-to-date and efficient generating apparatus must be installed. One plan involved the construction and equipment of an entirely new power house. This was abandoned, however, in favor of one involving the reconstruction and enlargement of the station on Brunots Island formerly operated by the Pittsburgh Railways Company.

This scheme offered many advantages. The site was already available, with plenty of room for extension if necessary, and careful investigation indicated that by using the existing station building and boiler room a very material saving in cost could be effected over that of a new station. This has been so far borne out by the actual cost figures, which show that the increase in equipment rating has been secured for less than 40 per cent of the original installation cost and for about 60 per cent of the cost of a complete new station. The site includes the entire island between the two channels of the Ohio and above the Ohio River Connecting Railroad bridge, about 60 acres of ground.

The present station is equipped with the latest up-to-date steam and electric generating apparatus and auxiliaries in units of large output, thus making it possible to reap all the advantages in efficiencies and low production cost.

Railroad and siding tracks are situated 50 ft. above the yard level, and machinery and other materials for the station are lowered to the ground by means of a 50-ton steel derrick. Fuel is brought to the plant normally by barges and is discharged by way of a coal dock and larry car to the crusher house, from which place it is distributed to the different coal bins over the boilers. When the coal receipts exceed the coal consumption the excess is put into storage. Ample facilities are also

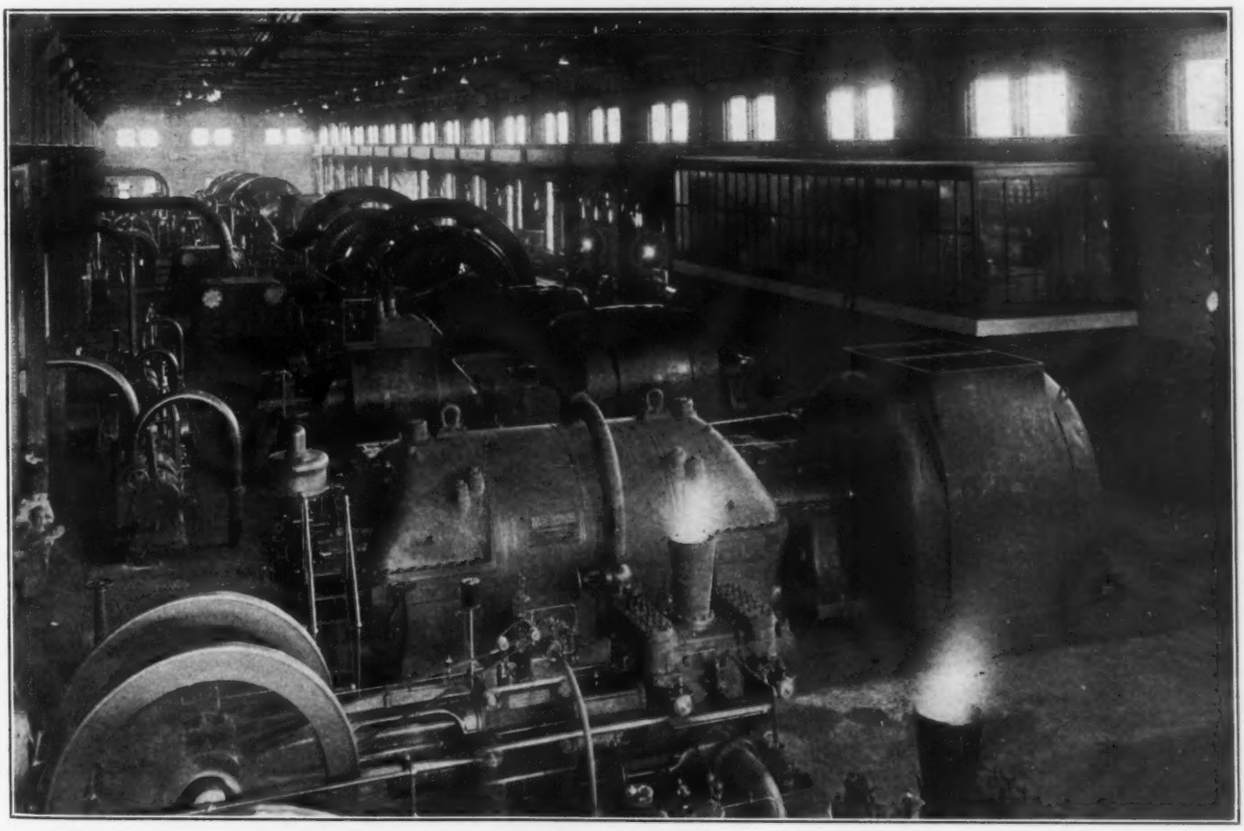


FIG. 1—GENERAL VIEW OF GENERATING ROOM, 18,000-KVA TURBINE UNIT IN FOREGROUND

available, when needed, for bringing in coal by rail, in which case it is dumped from the cars brought in to the private railroad siding alongside of the Ohio River Connecting Railroad Bridge.

Water for steam and condenser supply is obtained from the main channel of the Ohio River through two brick wells of 30-ft. diameter, each provided with six 5-ft.-square openings and sluicegates at three different levels. This arrangement was selected on account of the great variation of water level between low water and flood stage of the river in order to permit the water to be taken into the wells through the openings nearest the water surface, so that the amount of silt taken into the wells will be a minimum. The water passes through a double set of vertical screens in the center of the wells to an intake tunnel of 8-ft. diameter to the power station, which runs the full length of the station under the basement floor. The condenser suction pipes for the different units are connected to this tunnel. After passing through the condensers the water is discharged into a 5-ft. overflow tunnel running parallel to and over the intake tunnel and discharging into the river at a point 142 ft. below the intake wells. At a point above the wells a 30-in. pipe, provided with a gate valve, is taken off the overflow tunnel to allow of the discharge of warm condenser water above the wells and thus prevent ice from forming in front of the wells and closing up the openings to the river.

Steam is generated at 200 lb. pressure, superheated 125 deg. Fahr. All boilers are equipped with automatic stokers, and forced draught is available in the new boiler room.

Fuel and Ash Handling

The fuel dock is provided with an electrically operated coal hoist of 200 tons hourly capacity and a 4-ton grab bucket for removing coal from the barges to the larry car, which is of 14-ton capacity and is used for distributing coal to the crusher house or storage pile.

The crusher house, which is conveniently situated at the west end of the original boiler room, is connected by a chute with the railroad siding. All-rail coal is unloaded through the chute passing over a horizontal-belt conveyor running from the foot of the chute to the hopper under the coal track in the crusher house, and provided with a weightometer, which automatically weighs and records the coal passing over it. All-rail coal is used in the boilers, none of it being put into stock. The river coal taken from the barges is automatically weighed on track scales at the coal hoist when the larry car is loaded, and that part of the coal going to the boiler room is weighed again automatically on a track scale in the crusher house. The difference between the weights at the coal dock and crusher house is the weight of coal put into storage. All coal going to the boiler house is dumped into a hopper under the coal track in the crusher house, going from there through the crusher, if it is run-of-mine coal, to elevators which lift it to a belt conveyor running the length of the old boiler room. Slack coal by-passes the crusher, going directly from the track hoppers to the elevators. Automatic dumping apparatus is provided which can be set to discharge into any point of the boiler-room coal bunkers or into the cross-conveyor leading into the new boiler room. Each of the coal bunkers contains coal sufficient for sixty hours' normal running.

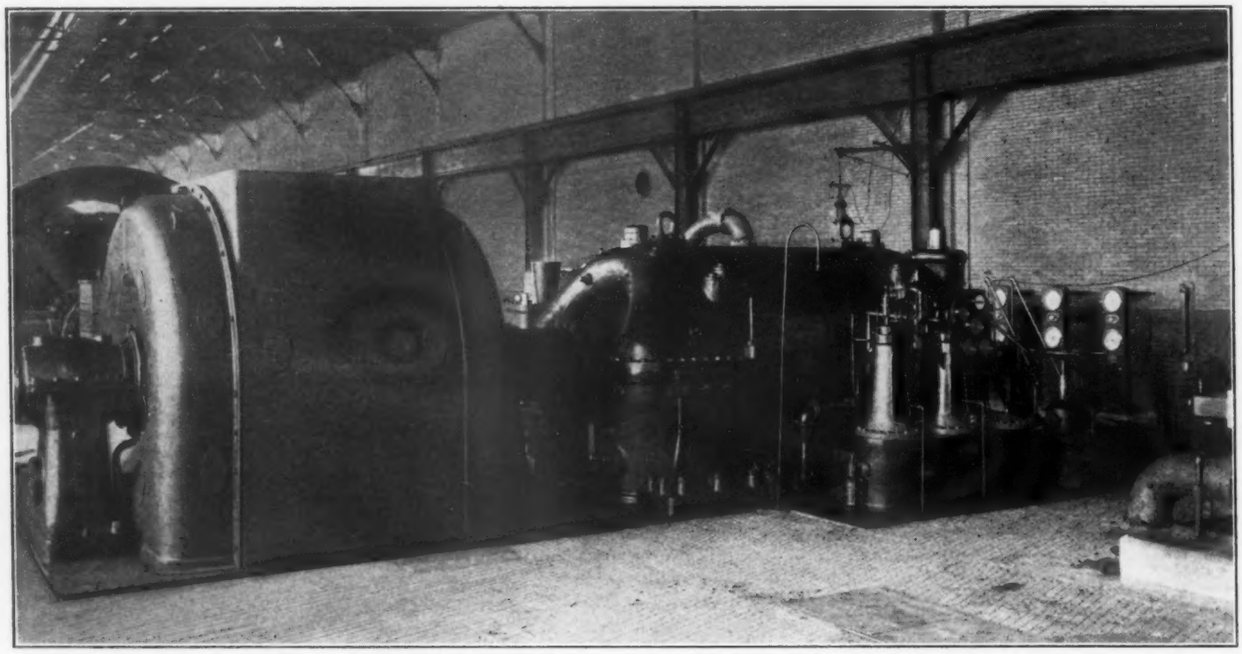


FIG. 2—VIEW OF 18,000-KVA WESTINGHOUSE-PARSONS TURBO-ALTERNATOR FROM GOVERNOR SIDE

In the storage yard is provided an electric locomotive crane of 200 tons hourly capacity for stocking and reclaiming the coal from the trench which the crane spans and into which the coal is dumped from the larry car. In this yard can be stored, if necessary, sufficient coal to run the plant for a period of nine months, thus amply insuring an adequate supply and providing opportunity to take advantage of low market prices of fuel and to tide over periods of possible coal strikes.

Ashes collect underneath the grates in hoppers, from which they are removed by means of ash car and skip to the ash bins outside the boiler room. Thence they are taken to the dump in larry cars.

Boiler Room

The boiler room is divided into the old plant and the new plant, the old plant being retained in order to facilitate the maintaining of service from the station through the reconstruction period and to be used as a standby or spare in the future, and also because it was cheaper to leave it in its present condition than to remove it and build a new boiler house in its place.

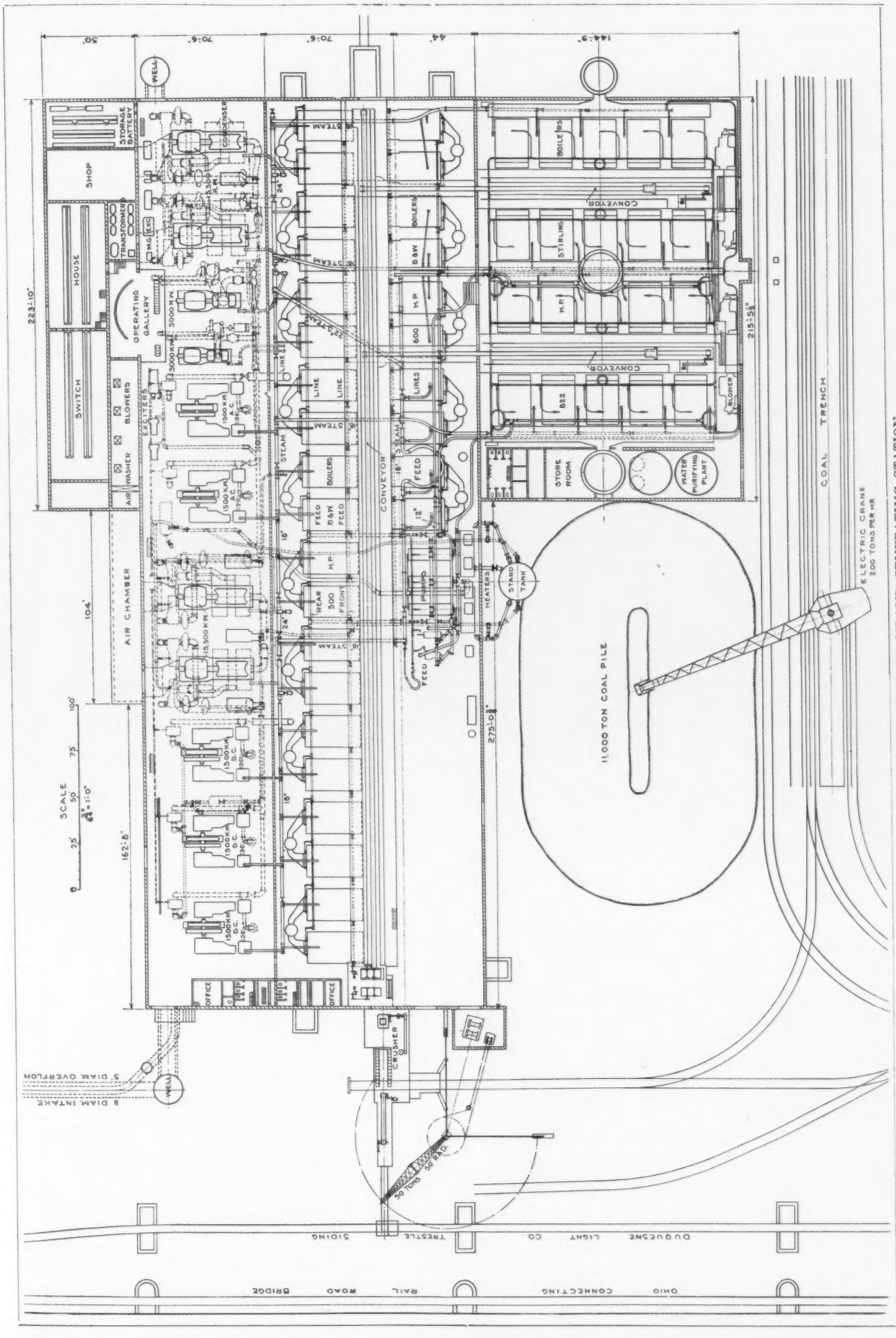


FIG. 3—GENERAL PLAN OF BRUNOTS ISLAND GENERATING STATION

The old plant contains twenty 500-hp Babcock & Wilcox water-tube boilers equipped with Murphy stokers and ten 600-hp Babcock & Wilcox water-tube boilers equipped with Roney stokers.

The new boiler plant, which it is intended to extend to take care of the ultimate generating equipment of the station, at present contains twenty 822-hp Stirling water-tube boilers equipped with Green chain-grate stokers. The boilers are arranged in rows of five, back to back, each ten boilers served by one stack except the single row of five on the east end of the station, which is served by one stack of smaller diameter. The stack on the west end is to serve five future boilers.

The stacks in the new plant are built of radial brick, the middle one being supported on a steel structure above the boilers. It is interesting to note that these stacks, the larger one 208 ft. high and 18 ft. inside diameter at the top, 19.5 ft. inside diameter at the bottom, and the smaller one 208 ft. high and 14 ft. inside diameter at the top and 15.5 ft. inside diameter at the bottom, were purchased erected for considerably less than the equivalent steel stack with which the old boiler house was equipped could have been purchased. These stacks, under ordinary conditions, provide sufficient draft to take care of the normal load without the operation of the blowers.

The stokers for each row of five boilers are operated from one line shaft provided with engine and motor

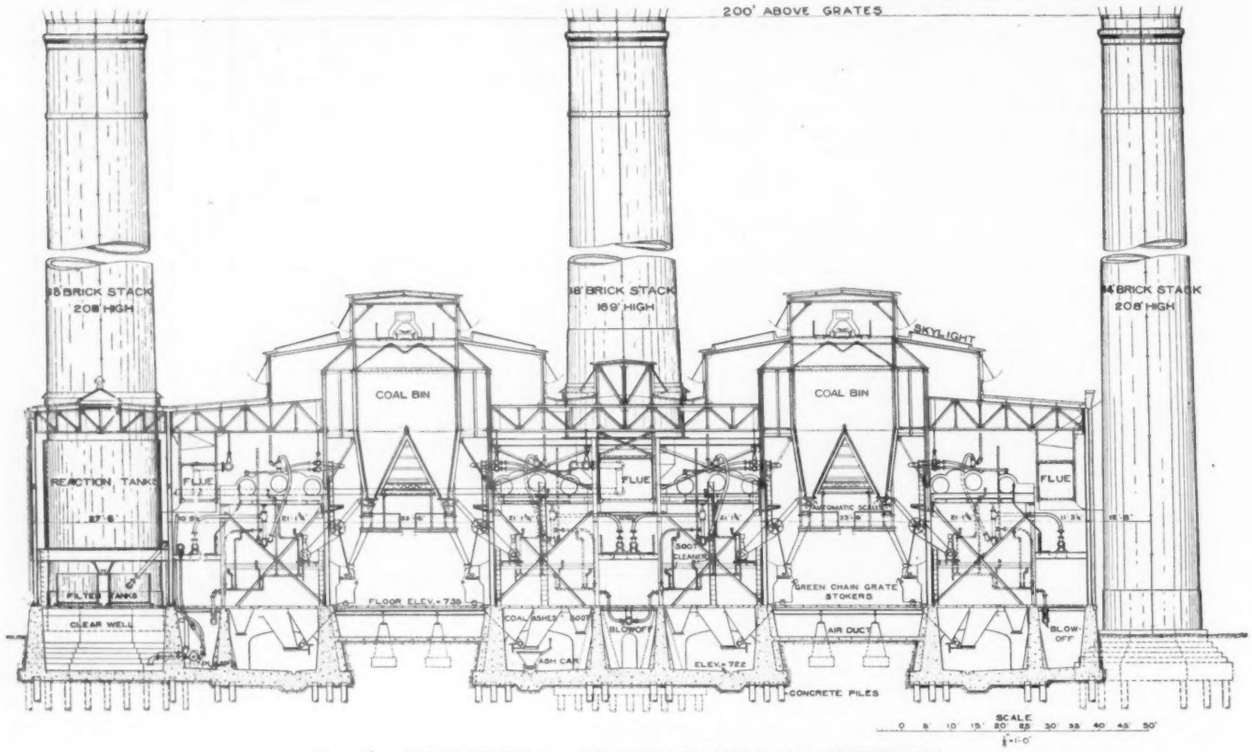


FIG. 4—CROSS-SECTION THROUGH BOILER-ROOM EXTENSION

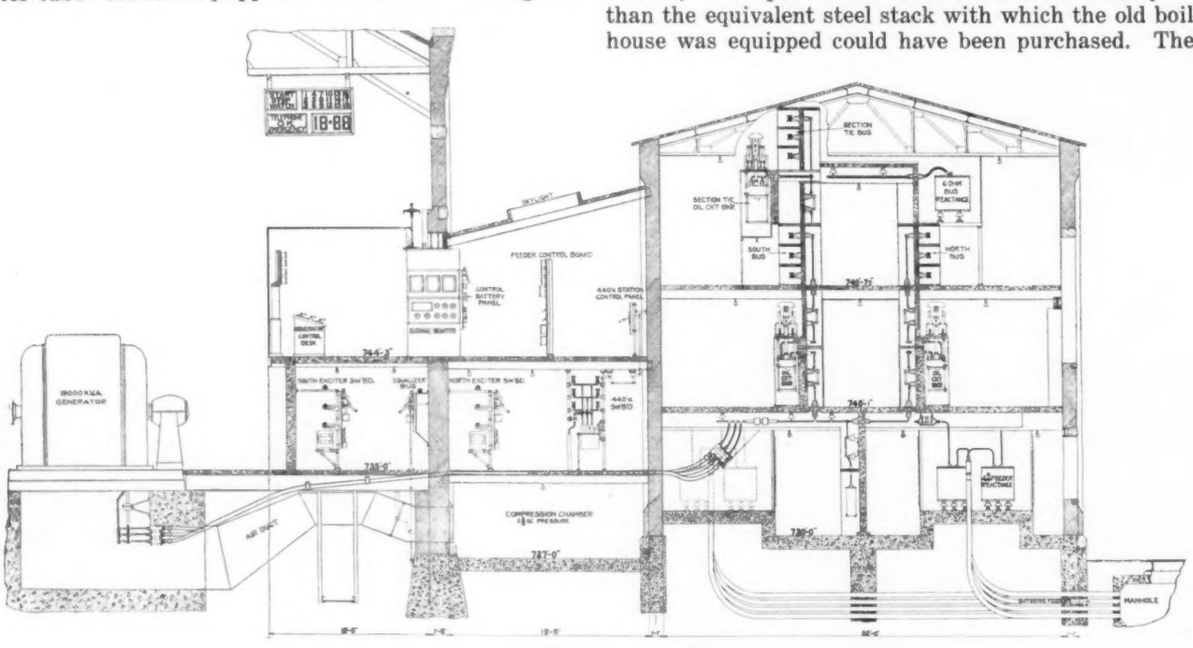


FIG. 5—SECTION OF SWITCH HOUSE AND CONTROL BALCONY

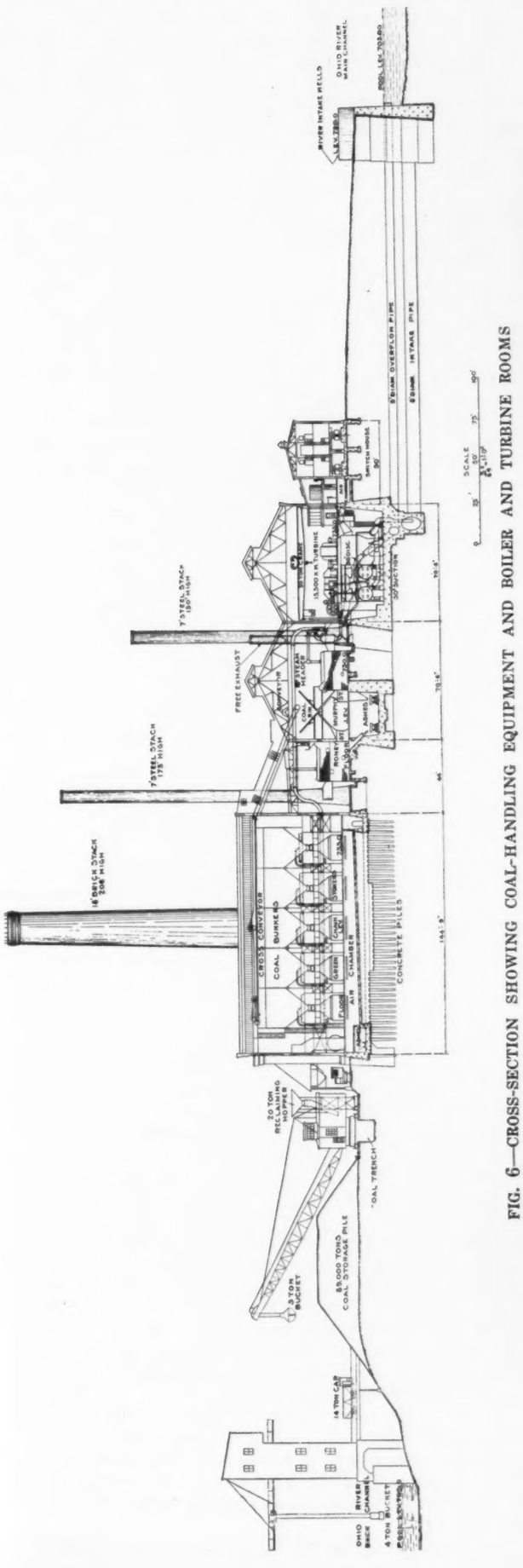


FIG. 6—CROSS-SECTION SHOWING COAL-HANDLING EQUIPMENT AND BOILER AND TURBINE ROOMS

drives at opposite ends of the shaft, engine and motor being set on platform above the floor in the aisles between the boilers. Any number of stokers can be disconnected from the driving shaft at any time, as when the boiler is out of service for repairs, or for any other

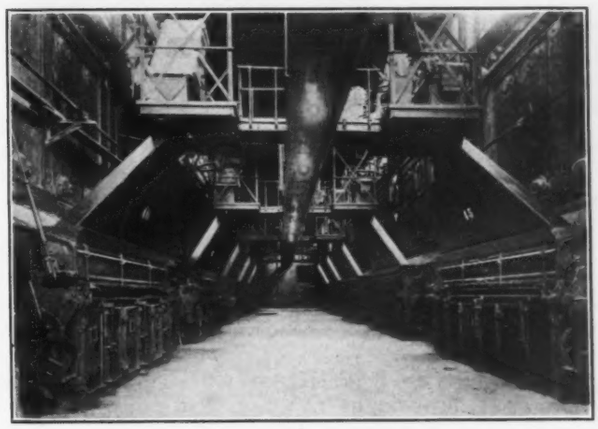


FIG. 7—AISLE IN NEW BOILER ROOM

reason. A speed variation of 30 r.p.m. to 60 r.p.m. is obtainable on the line shaft.

Over each stoker is arranged a spreader pipe from the coal bunker, at the upper end of which is an automatic 100-lb. dumping and recording coal scale.

The forced draft is obtained from a pressure chamber into which the blowers discharge and from which trap doors provide entrance for the air into a chamber underneath the stokers. The chamber underneath the stoker is also used as a collector for the unburned coal which drops through the stokers and is thus recovered for use instead of falling into the ashes. The boiler structure is also so arranged that the soot from the cleaning of the boiler falls into the ash pit and is removed in the same manner as the ashes, instead of having to be shoveled out from a more or less inaccessible soot door.

The Steam and Water Circulating Systems

The make-up water is taken from the overflow tunnel and is pumped across the engine and boiler rooms to the water-conditioning apparatus. After the water has passed through the filters and reaction tanks it goes to a 90,000-gal. clear well under the tanks, from which it is pumped by either of two 500-gal. turbine-driven centrifugal pumps to the stand tank. The water then passes through a Lea "V-notch" recording meter to the heaters. The condensate from the hot wells of the condensers of each 15,300-kw unit is pumped through the

FIG. 8—SWITCHBOARDS IN OPERATING GALLERY

boiler room and passes through Lea "V-notch" meters placed above the heaters, one meter for each unit, into the heaters. The boiler-feed pump equipment consists of two new 2000-gal. turbine-driven pumps and three 700-gal. plunger pumps.

Two 12-in. feed lines equipped with Venturi meters extend to the new boiler room and two 14-in. lines with Venturi meters pass to the old boiler room. The outlet of each boiler is provided with a General Electric flow meter. Thus there is provided, in connection with the automatic weighers which will also be checked by the weigher at the crusher, means for making records of boiler-room operation in such a way as to render readily available at any time complete information on its performance.

The arrangement of the connections to the steam headers is such as to make possible the operation of boilers and one turbo-generator on the unit plan, that is, with each turbo-generator and its set of boilers cut off from the remaining set.

In designing the piping system, particular pains were taken to make all lines as flexible as possible by the use of bends. Fittings, such as T's, elbows and Y's, were eliminated, pipe bends and welded necks being used instead.

Steam lines were made of steel pipe, low-pressure and water lines of wrought-iron pipe, and boiler-feed and blow-off lines of cast-iron pipe.

Generating Equipment

The generating station is laid out to contain ultimately ten 15,300-kw turbo-generator units with the necessary auxiliaries. Four of these, Nos. 1, 2, 6 and 7, are now installed. The remainder of the generating equipment now in use is old engine-type units and small turbo-generators originally used when operated as the Pittsburgh Railways Company power house, and will be removed to give place to the larger machines as fast as the increase in load on the station demands it.

The turbo-generator units are Westinghouse 15,300-kw, 85 per cent power-factor, maximum-rated, 12,000-volt, three-phase, sixty-cycle machines of 1800 r.p.m. The turbines are of the Westinghouse-Parsons double-flow combination impulse and reaction type, designed for operation on 185 lb. steam pressure, 100 deg. Fahr. superheat, 28.5-in. vacuum. A special hand-operated

FIG. 9—AIR WASHER IN GENERATOR INTAKE

valve has been furnished on these turbines to allow of short-period emergency operation up to 18,000 kw.

The condensers are of the Worthington duplex, surface type, served by two circulating pumps, each of sufficient size to operate the entire condenser—that is, one turbine—if necessary, though with slightly impaired vacuum.

The generators are cooled by forced air brought in at the bottom of the machine and discharged into the generating room out of the top of the machine.

To take care of the proper conditioning of the air, a washer has been provided, through which all the cooling air is drawn into a blower room alongside of the operating gallery on the generator-room floor level. At present one blower is provided for each generator, though it is probable that in the ultimate development

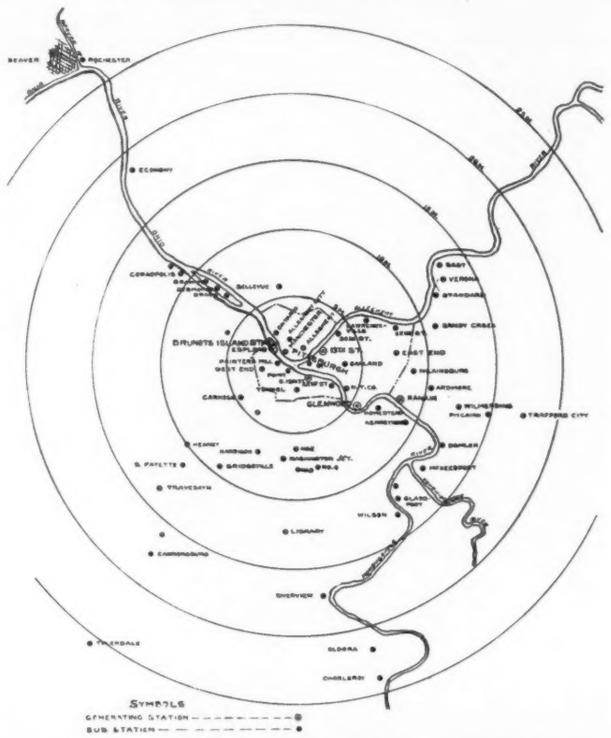


FIG. 10—MAP OF THE PITTSBURGH DISTRICT, WITH LOCATION OF PLANT

larger ones sufficient to cool three or four machines will be installed. Each blower is a No. 7 American Sirocco unit and is driven by a 100-hp Westinghouse motor, operating from the 440-volt, three-phase service.

The blowers discharge into a common compression chamber, which extends along the north side of the generating room between it and the switchhouse, leads to the individual generators being brought out from this common chamber, which is maintained under about a 2.3-ounce pressure. The flow to the individual generators is controlled by a damper in the inlet ducts. By means of this damper and a temperature indicator only sufficient cooling air will be used to keep the machine well within safe working temperature, the amount of air required being determined by the temperature of the cooling air and the load on the machine.

The air washer, with an output of 240 cu. ft. of air per minute, furnished by the Spray Engineering Company, consists of a row of vertical pipes, to which are attached spray nozzles directed horizontally in the direction of flow of the air against fine-mesh circular screens, one for each nozzle, which serve to break up the water into fine particles and insure an even distribution over the opening. The latter is about 15 ft. by 19 ft. Between the spray nozzles and the fan room the air passes through a labyrinth of eliminator plates set vertically across one end of the blower room. These serve to remove the free moisture from the air. The water drains into a tank, from which it is again drawn by a motor-driven circulating pump, which supplies the spray nozzles.

The washing of the air has a cooling effect that is of

considerable value in the warm summer months. In cold weather warm air from the generating room is mixed with the outside air to prevent freezing in the washers. It is also necessary to make use of steam in the water tanks to keep the temperature of the water above the freezing point.

The present washing equipment, which is sufficient for four machines, occupies a space, including the blower room, 15 ft. wide, 80 ft. long and 18.5 ft. high. When the remainder of the generators are installed a duplicate equipment will be similarly placed along the other half of the north wall of the station, so that both will take air from the common areaway between the generator room and the switchhouse, which latter will be extended west as the station grows.

The washing equipment is simple and inexpensive to operate, attention being required only in order to insure that there is sufficient water and that the pump motor is running.

Excitation

The main excitation for the plant is obtained from a 250-kw motor-driven and two 150-kw steam-turbine-driven Westinghouse exciters and one 150-kw steam-turbine-driven General Electric exciter. In order to

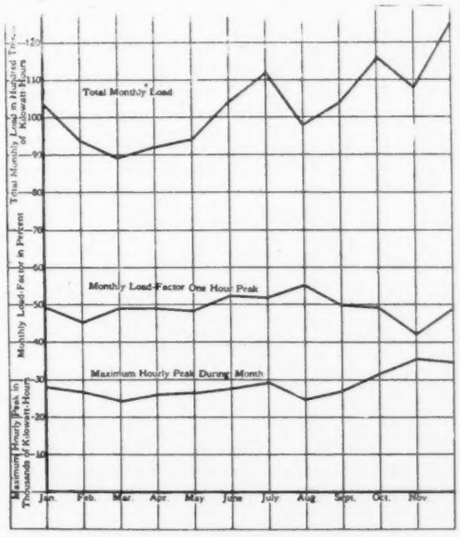


FIG. 11—LOAD-FACTOR AND LOAD OF BRUNOTS ISLAND PLANT

insure constant excitation, electric storage battery cells, ten of which are end cells, having a rating of 1750 amp for thirty minutes, were installed. This battery floats on the bus with the exciter generators. The voltage of the main generators is maintained by means of a Tirrill regulator connected to the field circuit of the small motor-driven exciter, which furnishes excitation to a motor-driven booster in series with the exciter bus, which booster, by bucking or boosting the exciter voltage automatically by the action of the Tirrill regulator, provides the varying voltages required on the generator-field circuit. The regulated bus pressure is maintained at approximately 170 volts, which is only about 10 volts above the emf required by the generator-field circuits, thereby eliminating a great part of the ordinary losses of the field rheostat. To charge the batteries the voltage of the exciter unit is raised and the field current taken care of by the series booster.

The equipment provided to take care of this consists of two 1750-amp motor-driven separately excited boosters and two 16.5-kw motor-driven booster exciters. These machines were furnished by the General Electric Company.

Control Room

The control room is situated about the center of the north side of the station, half of it projecting out into the generating room. The generators and the bus tie switches are controlled from a benchboard set along the side of the control gallery next to the generating room. The board is so laid out that the control switches and miniature bus are in the same physical relation to each other as the apparatus controlled. The attendant when operating the desk faces the generating room. A miniature bus is laid out on the board in such a way that the order of panels from left to right is the same as the circuit-breakers in the switch house behind the control room.

The feeder switches are controlled from a thirty-one-panel board, which forms an arc of a circle on the opposite side of the control room from the generator control desk and exciter control desk. At the left (facing the board) of the feeder switchboard are small panels carrying the control switches for the station power service.

The dominating idea in laying out the control room, it will be noticed, was to simplify the arrangement and make it conform as nearly as possible to that of the apparatus it controlled, thus reducing to a minimum the details of location of apparatus which the switchboard operator has to remember.

Station Signaling

The operator's desk is provided with a "Q P" signaling system, which enables him to indicate on an illuminated sign in the generating room information he wishes to convey to the operator in charge, such as instructions to start or stop a machine at a given time, that he is wanted at the telephone, etc. This sign is wired so that it duplicates in front of the switchboard operator the instructions on the sign in the generating room.

A similarly operated load bulletin is placed in the boiler room to indicate the load in thousands of kilowatts being carried, thus giving the operator in charge of the boiler room knowledge at all times of the proper load to take care of.

By the use of these illuminated signs all attendants are familiar with the instructions given, thus eliminating the possibility of a misunderstanding of the telephone instructions. This system of signaling is utilized in addition to the standard signals between individual machines and the switchboard operator.

The switching equipment, where not otherwise mentioned, was furnished by the Westinghouse Electric & Manufacturing Company.

Switch House

In arranging the switch house it was advisable to use the old building as far as possible, and this has been done with the necessary additions to take care of the new equipment.

Before the larger generators were installed some trouble was experienced from short-circuits in the cables leading to the numerous substations. The short-circuits, coming directly into the station without any transformers to act as a buffer, made serious disturbance. Such being the case, it was realized that some means must be provided for reducing the disturbance to a minimum and at the same time put the minimum strain on the switching equipment, which will ultimately have from 100,000 kw to 150,000 kw in generating output behind it. Under short-circuit conditions, such an enormous current could be sent into the injured cables that no circuit-breaker could be manufactured at a reasonable cost which would take care of it. Even if it were possible to use a circuit-breaker capable of

handling such a short-circuit, the disturbance resulting from sudden interruption would be undesirable, to say the least.

With the large increase in the output rating of the plant, and consequent increase in the number and equipment of the consumers served by the plant, it became necessary to consider very carefully a scheme of protection to the generated voltage which would insure, as far as possible, against interruptions from short-circuits in the cables leading to the various substations and against loss of voltage on the generator busbars, involving the falling out of step of the synchronous apparatus on the system.

It was apparent that the use of reactance coils in the feeder circuits would limit the minimum voltage on the busbars to an amount equal to the drop in voltage of the feeder reactance coils, at the same time limiting the current rush to a value which would put materially less stress on the switching equipment and generator windings. However, such an arrangement of reactance coils would give no protection against short-circuits on the generator bus system or generator cable leads between generator terminals and bus structure.

After an exhaustive study of the conditions involved, reactance coils were placed between bus sections for limiting the flow of current into an affected section. The voltage of the unaffected sections is maintained at a value which will guarantee the successful operation of synchronous apparatus. When the fault occurs outside the feeder reactance, there is a strong possibility that even the synchronous apparatus on the remaining feeders connected to the same bus sections will not drop out of step.

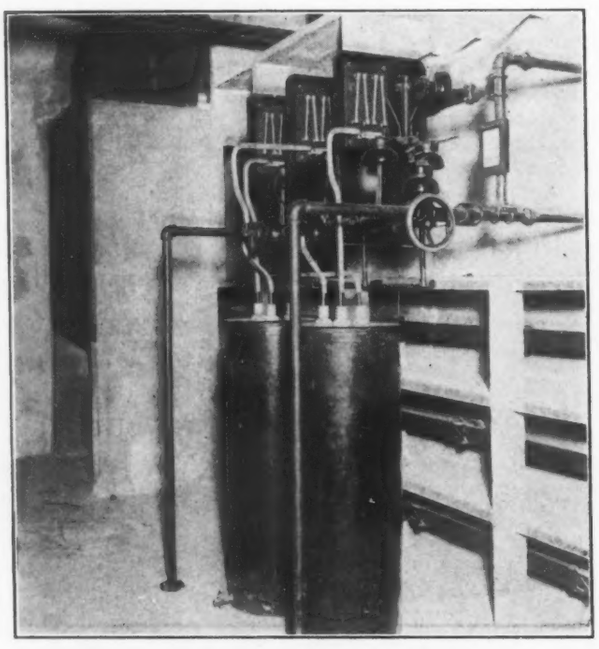


FIG. 12—2000-AMP TYPE C BUS-TIE SWITCH AND STATION PROTECTOR

It was found that if the reactance coils for the bus sectionalizing were sufficiently large to give adequate protection to the sections adjacent to the short-circuited sections there would be sufficient drop through them for the normal current which might circulate through different sections of the bus to cause a difference of voltage on such adjacent sections undesirable from an operating standpoint. To meet this objection the reactance coils are shunted by a circuit-breaker set for instantaneous operation, this breaker being guaranteed to open in a time less than that in which the synchronous apparatus would drop out of step. The additional non-automatic circuit-breaker permits cutting off the affected section, in case the short-circuit persists, with a minimum amount of disturbance to the adjacent sections of the busbars.

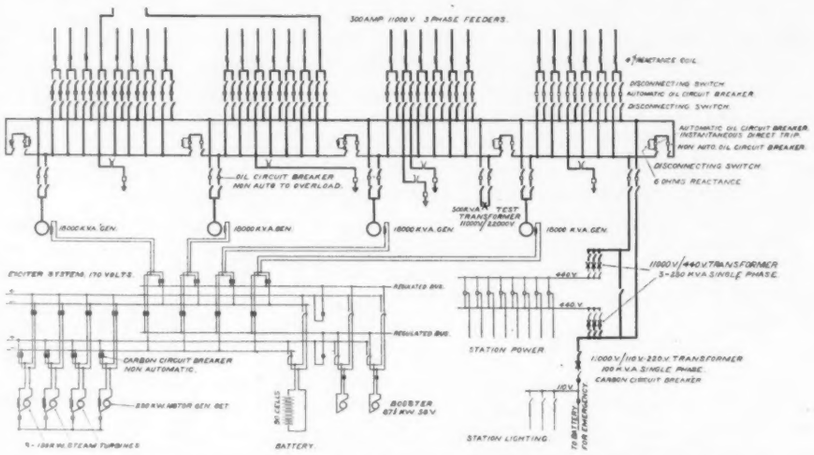

500 AMP. 11000 V. 3 PHASE FEEDERS.
REACTANCE COIL
DISCONNECTING SWITCH
AUTOMATIC OIL CIRCUIT BREAKER
DISCONNECTING SWITCH
AUTOMATIC OIL CIRCUIT BREAKER INSTANTANEOUS DIRECT TRIP
NON AUTO. OIL CIRCUIT BREAKER
DISCONNECTING SWITCH
6 OHMS REACTANCE
OIL CIRCUIT BREAKER NON AUTO TO OVERLOAD.
500 K.V.A. TEST TRANSFORMER 11000/2200 V
15000 K.V.A. GEN.
EXCITER SYSTEM, 170 VOLTS
REGULATED BUS.
REGULATED BUS.
11000 V/440 V. TRANSFORMER 3-250 K.V.A. SINGLE PHASE.
440 V.
440 V.
STATION POWER
1:000 V/110 V-220 V. TRANSFORMER 100 K.V.A. SINGLE PHASE. CARBON CIRCUIT BREAKER
CARBON CIRCUIT BREAKER NON AUTOMATIC.
250 K.W. MOTOR GEN. SET
BOOSTER 675 KW. 56 V.
110 V.
STATION LIGHTING
BATTERY.

FIG. 13—LAYOUT OF EQUIPMENT IN BRUNOTS ISLAND STATION

The above arrangement does not, of course, eliminate disturbance of the feeders attached to the sections of the bus affected, but by dividing the load as nearly as possible equally between the different bus sections, and connecting parallel feeders to the different sections, the effect of the trouble is limited to a small proportion of the system.

In order to isolate the bus section from a possible fault in the cables between the generators and busbars, the generator breaker is made automatic for a difference in current through series transformers at each end of the cable differentially connected through the trip coils of the breaker.

It is appreciated that in case of short-circuit on the busbars the above scheme offers no protection to the generators connected to that particular section of the bus, but on account of the generators being constructed with a view to withstanding such short-circuits without injury to the windings, and because of the remote possibility of bus trouble, reactance coils in the generator leads were not thought necessary.

It will be noted that a double bus is provided, generators and feeders being furnished with circuit-breakers for connection either to the through bus or to the individual sectionalized bus. Under normal operating conditions the generators and feeders are connected to the sectionalized busbars, which, with the through bus, form a ring. In case of trouble to any section the circuits are thrown to the through bus and the ring opens, the through bus then becoming a section, replacing the one in trouble.

Inasmuch as the feeders from the station leave entirely by submarine cable, no lightning protective apparatus is required, but an 11,000-volt, three-phase electrolytic lightning arrester is connected to each section of the bus as protection against voltage surges.

As installed at present, the switching equipment handles six generators and twenty-seven feeders. It is installed north of the generating station in the same section of the switch house and bus structure as was

used in the old installation, the reactance coils being added in the basement and the bus-sectionalizing switches, bus reactance and bus tie on the second floor. The generator and feeder breakers are installed on the main floor in a double row of reinforced-concrete structures, and the double busbar is installed on the second floor immediately over this structure with the bus-sectionalizing breakers above the main busbars so that the connections to them are as short as possible.

In order to reduce the fire hazard to a minimum amount, the switch house was divided into four sections by fireproof walls from the basement to the roof, thus preventing the possibility of the spreading of fire. The busbars and connecting straps are inclosed by fireproof doors constructed of asbestos lumber.

Since the installation of the feeder reactance coils their effectiveness has been demonstrated in two instances of severe short-circuits in feeder cables close to the power house. In one instance no synchronous apparatus dropped out of step, and in the other only one machine dropped out. Considering the fact that the feeders were connected to the through bus at the time, thus eliminating any chance of effect from the bus tie reactance, the results so far bear out expectations well.

In spite of the reconstruction work going on during 1914, the Island plant carried its share of the system load and even took care of a fair increase, the average daily output amounting to 340,000 kw-hr. in 1914, as compared with 296,000 kw-hr. in 1913, or a total increase for the year of 16,000,000 kw-hr. During the year the East End plant, with an annual output of 1,700,000 kw-hr., was shut down. Other plants to be shut down and the additional demand put on Brunots Island as a result will be: Manchester, 15,000,000 kw-hr.; Glenwood, 20,000,000 kw-hr.; Southside, 1,200,000 kw-hr.

In connection with the maximum hourly peak, which shows no very marked variation from month to month, it is interesting to note that the swings in load are 10 per cent in excess of the integrated hourly readings. This fact illustrates the necessity for automatic voltage regulation, which is not required in some other large systems having a more even load.

The load curves in Fig. 11 show by their gradual increase the use to which the new apparatus is being put.

A 480-FT.-HEAD VERMONT WATER-POWER

Features of 6000-Hp Hydroelectric Station at Chittenden, Which Conserves Energy of Flow Between Two Reservoirs

WATER that had been allowed to run from one reservoir to another 480 ft. below without doing any useful work is now being utilized by the Pittsford Power Company at Chittenden, Vt., for developing electrical energy. While the head available is not large in comparison with those obtained in the West, it is the highest which has been utilized in the older states of the East. Moreover, since the water in the lower reservoir was and is still being used to operate 1200 kw in generating equipment, the supply from the

FIG. 1—SECTION OF WOOD-PIPE LINE SUPPLYING 6000-HP WATER-POWER PLANT AT CHITTENDEN, VT.

upper reservoir could not be diverted during construction, and hence the new station was erected near the lower basin, where the maximum head can be obtained and the water discharged into that reservoir.

Reservoir and Pipe Line

Although the higher reservoir affords a 480-ft. head, its capacity is comparatively small, the quantity of water impounded being about 1,000,000,000 cu. ft. The area of the watershed is about 16 sq. miles. From the reservoir to the generating station the water is conveyed through wood-stave and steel pipes. As the first 13,400

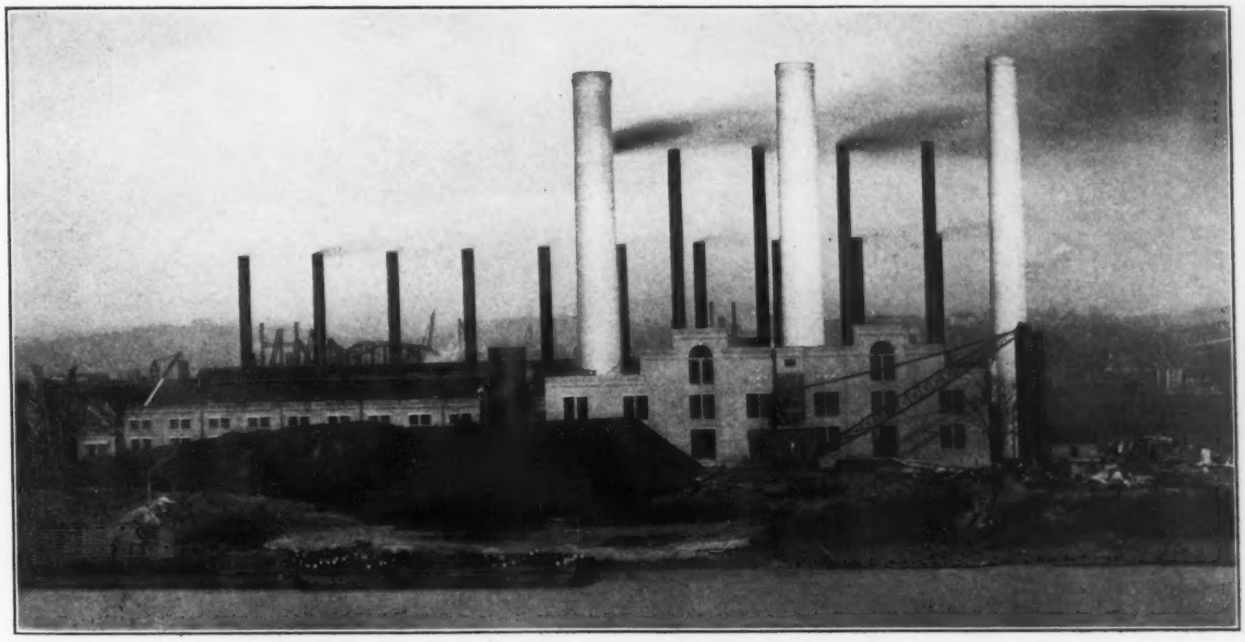


FIG. 14—BRUNOTS ISLAND POWER HOUSE SEEN FROM BACK CHANNEL OF OHIO RIVER

ft. of the route was practically level, or in such condition that it could be graded to 0.3 per cent incline, 5-ft. spruce and Douglas fir stave pipes were employed, with few exceptions. For the remaining 2700 ft. leading to the station, however, there was a considerable incline,

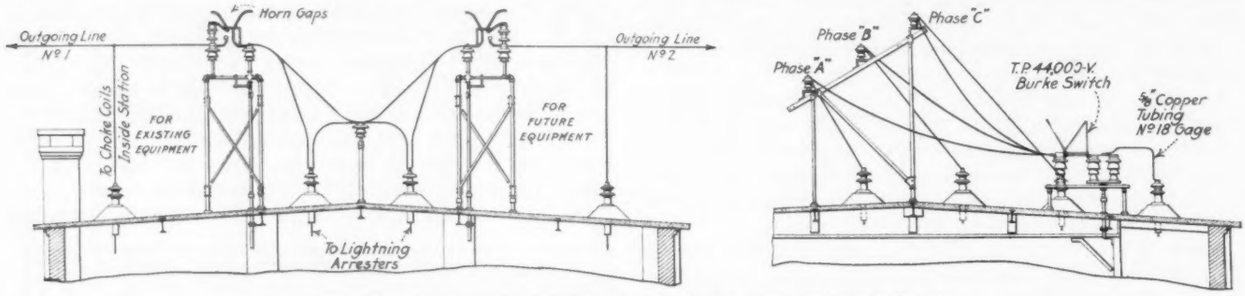


FIG. 2—LIGHTNING-ARRESTER STRUCTURE ON STATION ROOF

hence steel pipe ranging in size from 54 in. to 52 in. had to be employed.

Relief valves and a surge tower were installed at several points. A vent was installed between the outlet valve of the reservoir and the penstock to prevent the pipe collapsing should water be drawn out too fast. It consists of a 24-in. steel standpipe 55 ft. high. The pipe is protected by a double casing of wood staves and in winter is heated electrically. At the junction of the wood and steel pipe is the surge tower, which stands 90 ft. high, the top being 19 ft. higher than the flashboards on the dam above. The tower is 14 ft. in diameter and is protected from freezing by a casing of 2-in. planks covered with wire lath and cement.

Layout of Station

The station is a single-story structure 38 ft. wide by 71 ft. long. It is arranged so that the steel penstock enters one end of the building and then continues longitudinally, branching into three 24-in. nozzles leading to the turbines. Space is provided for installing one row of three prime movers, but only two are in place at present. Each unit is rated at 2000 hp and 720 r.p.m. The turbines are of the Francis type and are directly connected with the generators. The gate-operating mechanisms are controlled by Lombard governors of the directly connected type, these being arranged for electrical control.

To protect the pipe line against undue rise of pressure when a governor throttles the water passing to its respective turbine, a relief valve has been installed capable of discharging 30 cu. ft. of water per second. A 52-in. recording Venturi meter is employed to measure the total amount of water supplied to the turbines. As

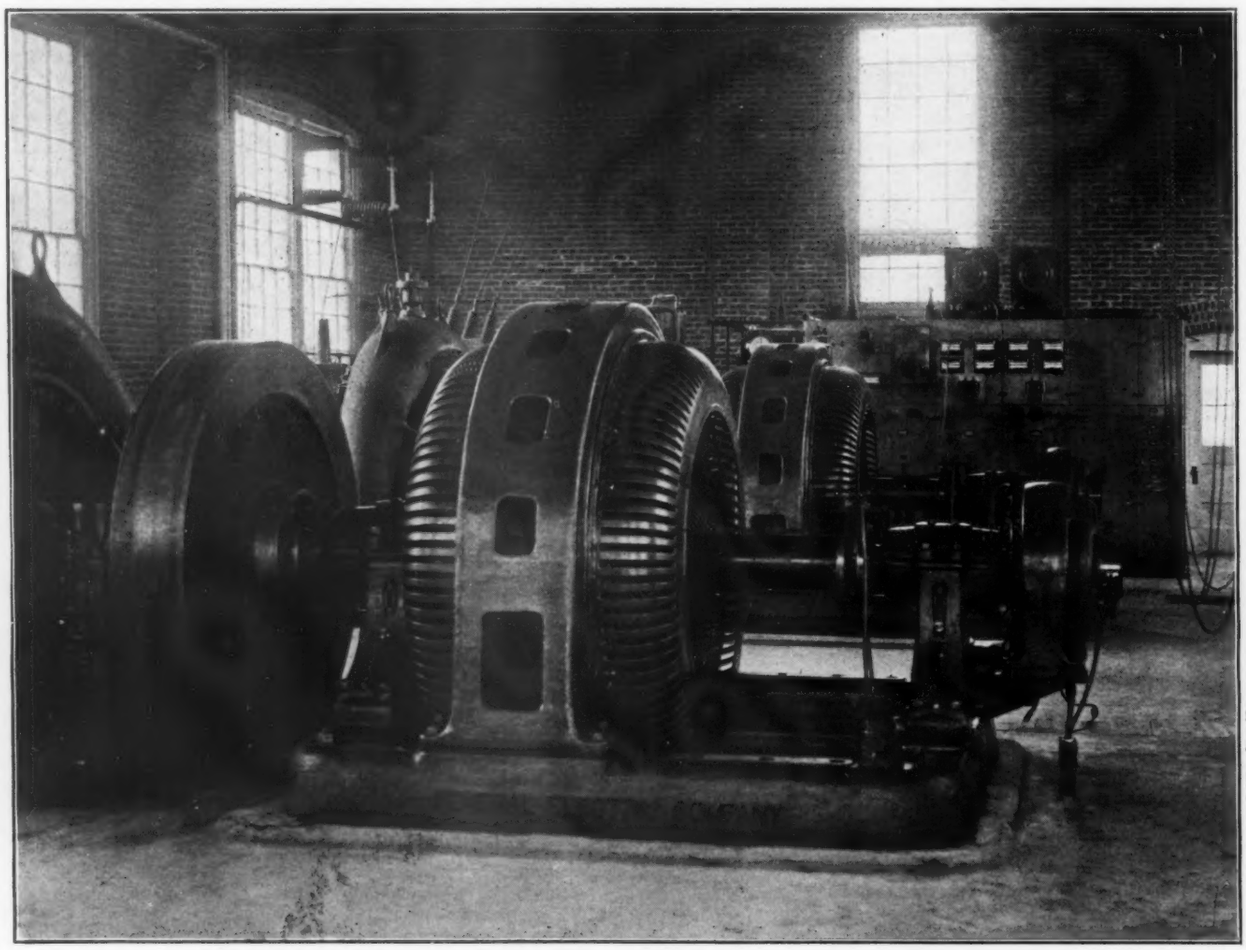


FIG. 3—INTERIOR OF GENERATING STATION AT CHITTENDEN, VT.

the tailrace extends under each prime mover, long draft tubes are not required.

Electrical Equipment

The three-phase, sixty-cycle, 2300-volt, 1250-kva General Electric generators operate at 720 r.p.m. Their exciters are directly connected to the main shafts and are controlled by Tirrill regulators. From the gen-

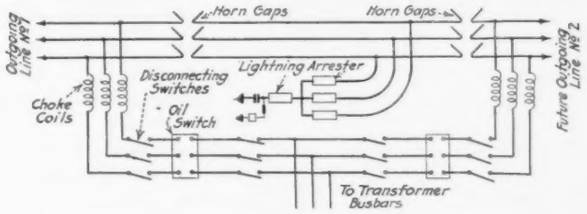


FIG. 4—ONE SET OF LIGHTNING ARRESTERS SERVING TWO LINES

erators energy is conveyed through lead-covered, varnished-cambric insulated cables, disconnecting and remote-control oil switches to a sectionalized 2300-volt bus made of copper tubing and supported in a vertical plane along one wall and above the transformers. At present there are installed six single-phase, 2300/44,000-volt, 400-kva water-cooled transformers. These are arranged in a single row, three units being mounted opposite each turbo-generator set. Water for cooling the transformers is taken from the penstocks through pressure-reducing valves. It will be possible in the ultimate installation to divide the 2300-volt bus into three distinct sections which may be connected in any combination by means of a transfer bus.

All of the 44,000-volt busbar and switching equip-

FIG. 5—SINGLE TANK AND HEATER HOUSE OF PITTSFORD POWER COMPANY

ment, with the exception of the electrolytic lightning arresters, is installed on the roof of the station, connection being made therewith by copper tubing passing through insulated roof bushings. In this circuit are inserted three-pole air-break switches which can be operated from the station floor. The air-break switches, lightning-arrester horn-gaps and copper-tube high-tension busbars are mounted on pipe framework supported on the roof. Conductors lead from the horn-gaps

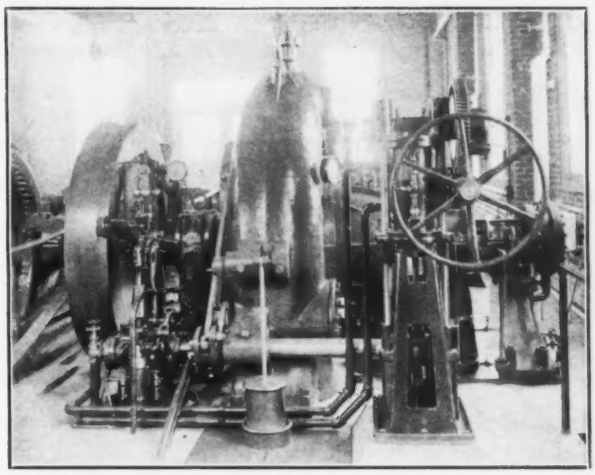


FIG. 6—GOVERNING MECHANISM OF ONE PRIME MOVER

through roof bushings, choke coils and disconnecting switches to single-phase electrolytic lightning arresters installed inside the station.

Only one transmission line has been erected so far, this being operated at a pressure of 44,000 volts and controlled by means of indoor-type, remote-controlled oil switches.

Interior Illumination

General interior illumination is afforded by six 250-watt tungsten lamps set in deep-bowl reflectors supported close to the ceiling. The outlet boxes and connecting conduit are molded in the concrete roof. Additional illumination can be obtained by connecting portable lamps to the plug receptacles distributed around the walls of the building. A number of lamps supported on goose-necks and equipped with enameled reflectors are installed on the roof to provide illumination in case the high-voltage equipment has to be inspected at night. The lamp circuits can be energized from either the exciter busbars or from a 3-kw transformer connected with the 2300-volt busbar.

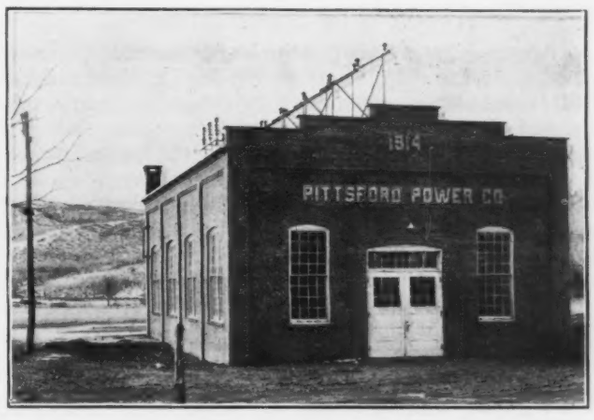


FIG. 7—STATION WITH HIGH-VOLTAGE EQUIPMENT INSTALLED ON ROOF

The Pittsford Power Company's development was designed and constructed under the supervision of W. S. Barstow & Company, engineers and managers, 50 Pine Street, New York City.

Differential Method for the Determination of Losses in Coils

BY AUGUST HUND, SAN FRANCISCO, CAL.

Some time ago the writer published[1] a paper in which a differential method for measuring the dielectric losses in condensers was described. A differential arrangement of the same kind is also applicable to the measurement of losses in coils, not only at low frequencies[2], but also at very high frequencies. The object of this article is to point out the application of this method to such measurements.

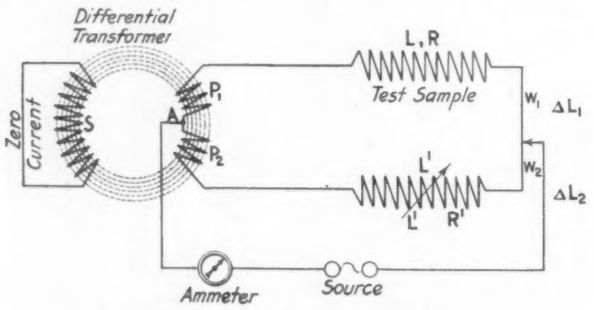


FIG. 1—TEST CIRCUIT ARRANGEMENT

The self-induction and effective resistance at high frequency are usually determined by the ordinary Wheatstone-bridge method, or the power loss is determined directly by tuning the circuit for resonance and measuring the current and voltage by means of a hot-wire ammeter and voltmeter respectively. At frequencies as low as 500 cycles per second such methods are to be recommended for commercial use, but at higher frequencies, particularly when the voltage is over 100, the reading of the hot-wire voltmeter may be very inaccurate. For instance, at frequencies of from 50,000 to 100,000 cycles per second it sometimes happens that the readings are inaccurate to such an extent that the power-factor calculated from these readings is greater than the unity. For high-frequency measurements, when the voltage is over 100, it is usually more advisable to calculate the voltage from the impedance and current than to use a hot-wire voltmeter. The differential method here described overcomes these difficulties and gives a simple as well as an accurate means of measuring both the effective resistance and the effective inductance.

Principle of the Differential Method

The principle of the method may be readily understood from the diagram shown in Fig. 1. The differential transformer consists of two equal primary coils, P_1 and P_2, wound in opposite directions and symmetrically placed with reference to the secondary coil S. When the currents in the two coils are equal in effective value and are in phase, their inductive effects on the secondary coil will exactly neutralize each other, and no voltage will be induced in the secondary. Any kind of alternating-current detector connected across the terminals of the secondary will then give a no-current indication when the currents in P_1 and P_2 are equal and in phase.

With the connections as shown and the currents in P_1 and P_2 equal and in phase, the total resistance of P_1, the test sample, and the resistance w_1 must be equal to the total resistance of P_2, the reference coil, and the resistance w_2, and the self-inductions of these two branches must also be equal. The resistances w_1 and w_2 are formed by a short length of non-magnetic high-resistance wire, and the contact B is a sliding one. By adjusting the self-induction of the reference coil and removing the contact B, the condition of no current in the secondary coil may be established. For this adjustment

$$R + w_1 = R' + w_2$$

or

$$R = R' + w_2 - w_1. \qquad (1)$$

Similarly for the inductances,

$$L + \Delta L_1 = L' + \Delta L_2$$

or

$$L = L'\left(1 + \frac{\Delta L_2 - \Delta L_1}{L'}\right). \qquad (2)$$

The self-induction of the short high-resistance wire will usually be small compared with that of the test sample, and therefore to a first approximation $\Delta L_2 - \Delta L_1$ may be neglected, in comparison with L', in which case $L = L'$.

It is to be noted that the difference of the resistances is not affected by inductive effects of the resistances w_1 and w_2. This is a decided advantage of the differential method, in comparison with the usual bridge arrangements, where inductive effects of the resistances introduce considerable errors.

The skin effect in an ordinary variable inductance coil is appreciable at high frequencies, and consequently the resistance R' will depend on the frequency, unless a specially designed variable inductance is used. This difficulty may be avoided by using the arrangement of Fig. 2. The currents in the two branches of the parallel circuit can then be brought into phase by adjusting this capacity to such a value C that

$$\omega^2 LC = 1, \qquad (3)$$

where ω is 2π times the impressed frequency. To make the currents equal in effective value, the relation between R and R' will then be the same as before, viz.,

$$R = R' + w_2 - w_1. \qquad (4)$$

Equation (3) gives the value of L in terms of C when the frequency is known, but when the frequency cannot be measured accurately L may be determined by using the connections shown in Fig. 2. The non-inductive resistance in series with condenser is made equal to the resistance R of the test sample, previously determined by the method just described, and the capacity C is kept at the same value as before, so that equation (3) still holds. Under these conditions the

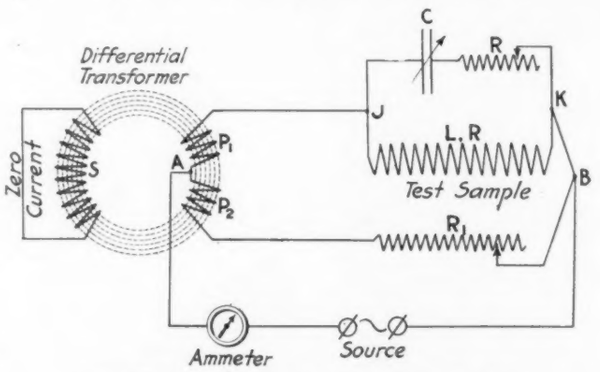


FIG. 2—MODIFIED CIRCUIT ARRANGEMENT

parallel circuit from J to K is in resonance with the impressed frequency, and therefore this circuit as a whole is non-inductive, having an equivalent resistance R_1 such that

$$\frac{1}{R_1} = \frac{R}{R_2^2 + (\omega L)^2} + \frac{R}{R^2 + \frac{1}{(\omega C)^2}} = \frac{2R}{R_2^2 + (\omega L)^2}.$$

[1] A. Hund, London *Electrician*, Jan. 8, 1915, abstracted in ELECTRICAL WORLD, Jan. 30, 1915.

[2] H. Hausrath, "Untersuchung elektr. Systeme," etc., page 61, Berlin, 1907; Niebuhr. *Diss.*, Karlsruhe, 1907.

Hence

$$R_1 = \frac{1}{2}\left[R + \frac{(\omega L)^2}{R}\right] = \frac{1}{2}\left[R + \frac{L}{RC}\right]. \quad (5)$$

For no current in the secondary the resistance in series with the primary P_1 must then be made equal to this value, and the value of L is then, from equation (5),

$$L = RC(2R_1 - R). \quad (6)$$

After having determined L from equation (6) the frequency f may then be calculated from equation (3), viz.,

$$f = \frac{1}{2\pi\sqrt{LC}}. \quad (7)$$

No-Current Detector

For frequencies between 500 and 2000 cycles per second a telephone receiver is the simplest and most dependable indicator. When the test sample has an iron core, the wave form of the currents in the two primaries will not be the same, and consequently absolute silence in the telephone cannot be obtained. Under such conditions it is advantageous to insert a condenser in series with the receiver and the secondary and tune this circuit for resonance with the fundamental frequency. When a vibration galvanometer is available it may be

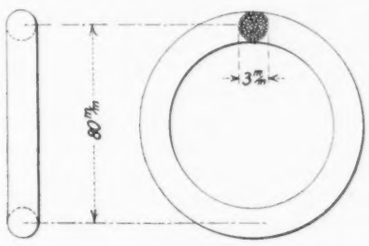


FIG. 3—TRANSFORMER CONE

used as a current detector and the condenser may be dispensed with. When large currents can be used in the test sample and parallel circuit an ordinary thermocouple connected to a galvanometer may be used, although a thermo-cross-bridge[3] will be found preferable.

It is of interest to note that maximum sensitiveness is obtained when the secondary of the differential transformer is so designed that its total reactance ωL_2 (measured with the primary coils open) is equal to the impedance $\sqrt{(R + r_2)^2 + \omega^2 L^2}$, where R is the resistance of the no-current indicator, L the inductance of the no-current indicator, and r_2 the resistance of the secondary coil. This may be proved as follows: The two primary coils may be treated as a single coil carrying the differential current $i = i_1 - i'_1$, where i_1 and i'_1 are the currents in the two primary coils. This current will induce in the secondary coil an emf equal to $-M\frac{di}{dt}$, where M is the coefficient of mutual induction between one primary coil and the secondary coil. The effective value of the induced secondary emf is then $E_2 = \omega MI$, where I is the effective value of the differential current I, and ω is 2π times the frequency. The secondary current is then

$$I_2 = \frac{\omega MI}{\sqrt{(R + r_2)^2 + \omega^2(L + L_2)^2}}.$$

If there is no magnetic leakage, the mutual induction, M, is directly proportional to the secondary turns, and the self-induction of the secondary coil, L_2, is proportional to the square of the secondary turns. Hence $M = k\sqrt{L_2}$, where k is a constant. Hence the expression for I_2 may be written

$$I_2 = \frac{k\omega\sqrt{L_2 I}}{\sqrt{(R + r_2)^2 + \omega^2(L + L_2)^2}}. \quad (8)$$

The value of L_2 which will make this a maximum is found by equating to zero the derivative of I_2 with respect to L_2, for k, w and I constant. This gives

$$\frac{dI_2}{dL_2} = \frac{k\omega I[2\omega^2 L_2(L + L_2) - (R + r_2)^2 - \omega^2(L + L_2)^2]}{(R + r_2)^2 + \omega^2(L + L_2)^2} = 0,$$

or

$$\omega L_2 = \sqrt{(R + r_2)^2 + \omega^2 L^2}. \quad (9)$$

When the no-current indicator is non-inductive this becomes $\omega L_2 = R + r_2$. When a condenser of capacity C is inserted in series with the detector the expression for the secondary current is

$$I_2 = \frac{k\omega\sqrt{L_2 I}}{\sqrt{(R + r_2)^2 + \left[\omega(L + L_2) - \frac{1}{\omega C}\right]^2}}. \quad (10)$$

When the capacity of the condenser is adjusted for resonance with $(L + L_2)$ the second term under the radical in the denominator becomes zero, and the maximum value of I_2 is then obtained when L_2 is made as large as possible.

Construction of the Differential Transformer

Three differential transformers for measurements with frequencies of from 50 cycles to 2500 cycles per second have been constructed by the writer. In one the iron core was built up with fine soft iron wire in the form of a toroid. The dimensions are shown in Fig. 3. Before winding the coils the iron core was thoroughly insulated. Three layers of enameled copper wire (0.15-mm diameter) were then wound on it, each layer being insulated from the next by paraffined paper. Each layer had 1293 turns. The total length of the wire in this secondary coil was 147 meters, giving an ohmic resistance of approximately 90 ohms. The last layer was insulated with tape, and upon it were wound 151 turns of enameled wire strand (four wires per strand, each 0.35-mm diameter), this strand forming the two primary coils. The total length of the strand was 7.775 m, each wire having a resistance of 1.2 ohms. The other two differential transformers were of similar design but with ratios of 1:4 and 1:8 respectively.

For measurements at high frequencies, such as are used in wireless work, an air transformer was used. In order to keep down the losses of the transformer only six turns, wound on a wooden core, were used for each primary coil, the diameter of the wire being approximately 0.15 mm. For the secondary coil nine turns were chosen, although it is usually advisable to use the number required for maximum sensitiveness, according to formula (9).

Applications

The differential method above described has been used by the writer to measure the variation with frequency of the resistance and inductance of a choke coil, for frequencies ranging from 588 cycles to 1845 cycles per second and for currents ranging from 0.205 amp to 0.737 amp. For this purpose the iron-core differential transformer was used.

The differential method was also used to compare the high-frequency resistance of a woven copper strand, a copper strap built up of thin ribbons and a solid copper strap. These tests were made for wave-lengths ranging from 320 m to 1825 m and at a current of 0.5 amp.

[3] A. Hund, *Diss.*, Karlsruhe; *General Electric Review*, October, 1915; London *Electrician*, Jan. 8, 1915; ELECTRICAL WORLD, Jan. 30, 1915; *Arbeiten aus dem elektr. Institut Karlsruhe*, Vol. III.

DIGEST OF ELECTRICAL LITERATURE

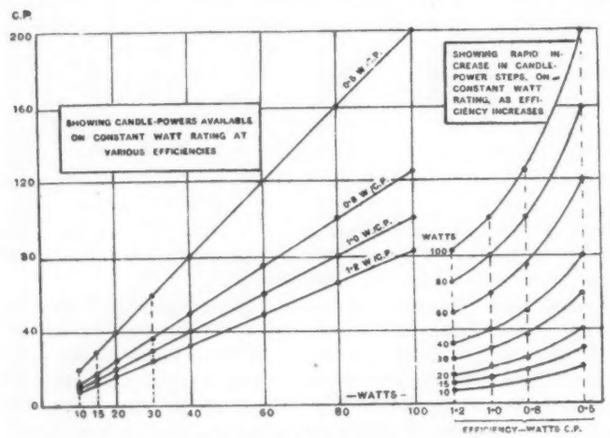
Generators, Motors and Transformers

Transformer Theory.—JOHANN LISSNER.—The author develops the fundamental differential equations of the theory of stationary transformers. The theory is based directly on the laws of induction and is exact as far as it goes, but it neglects eddy currents, saturation phenomena, and hysteresis.—*Elek. u. Masch.* (Vienna), March 28, 1915.

Lamps and Lighting

Mechanical Equivalent of Light.—HERBERT E. IVES, W. W. COBLENTZ AND E. F. KINGSBURY.—A long paper in which rational definitions are given for light quantities. In accordance with these the mechanical equivalent of light is defined as the value of the lumen in watts. An experimental determination by two different methods gives for the mechanical equivalent of light a mean value of 0.00162 watt per lumen. Luminous flux, on the basis of the accepted definition, can be measured in c.g.s. units, for example, in watts, and consequently the watt is a rational standard of luminous flux ("primary standard of light"). The measurement of luminous flux in watts and the establishment of the watt as the standard are dependent on the evaluation of the present standard and units in terms of the watt. The mechanical equivalent of light is, therefore, the most fundamental quantity in the establishment of light measurement on a physical basis.—*Phys. Review*, April, 1915.

Rating of Metallic-Filament Lamps.—S. M. POWELL.—The author emphasizes the fact that the rating of incandescent lamps by watts is convenient for the manufacturer but neither desirable nor convenient for the user. He urges that the rating should be in terms of candle-power. The peculiar polar curve of many modern lamps and reflectors has been made an objection to rating by candle-power. The objection does not apply at all if lamps be rated, as they should be rated, in mean spherical candle-power. Both watts and mean spherical candle-power should be marked on the lamps, but candle-power should be the basis of sizing. The present practice has been to use the watts as the basis of sizing, so that when a consumer used 30-watt lamps and the specific consumption fell from 1.2 watt per cp to 1 watt and 0.8 watt, the consumer got formerly 25-cp lamps, later 30-cp lamps, and now 37½-cp lamps. Continuously increasing the candle-power of an installation is not only unnecessary, but is, after a time, objectionable and harmful, and reference to the cut shows that the gaps in the candle-powers available become rapidly greater as efficiency rises, the watt series remaining constant. "The fact that the consumer has to make fresh compromises with every increase in lamp efficiency—using a lamp either more or less powerful than the one he wants (except for accidental coincidences)—leads inevitably to a certain amount of dissatisfaction, whereas on a constant candle-power system of rating there would be nothing but satisfaction caused by the higher efficiency, every consumer getting the same light as before at less cost."—London *Elec. Review*, April 30, 1915.



CANDLE-POWERS AVAILABLE WITH DIFFERENT SPECIFIC CONSUMPTIONS

Generation, Transmission and Distribution

Bombay Water-Power Developments.—A. DICKINSON.—A long abstract of a paper read before the (British) Institution of Electrical Engineers on the Tata Hydro-Electric Power Supply Company, Ltd., Bombay. The company supplies electrical energy in Bombay, principally for motors in cotton mills. The hydraulic section of the scheme is exceptional, inasmuch as lakes have been created, and the whole of the water for the plant is collected from the rain falling during the monsoon. Three reservoirs are being formed by constructing dams across valleys known as Lonawla, Walwhan and Shirawta. From the reservoirs the water is conveyed in an open duct to the forebay, and thence through pipe lines to the power house, a distance of 13,000 ft., in which length there is a fall of 1725 ft. The power house is situated at a place know as Phopoli, which, as the crow flies, is some 43 miles from the receiving station on the island of Bombay. The present scheme is to install in the power house eight units, each of 11,000 hp, and in the receiving station the plant necessary to deal with the power-house output. Five sets only are now installed in the power house, and the remaining three sets will be put down as water becomes available. Generation is at 5000 volts, three-phase and fifty cycles, the energy being transformed up to a line pressure of 100,000 volts. The receiving station is situated at Parel, on the island of Bombay. It has been designed for an ultimate plant rating of 74,880 kva in eight three-phase step-down transformer banks of 9360 kva each, and four incoming lines with the necessary switch gear and station auxiliary apparatus, of which five complete units and two incoming lines are now being installed. Each step-down transformer bank consists of three General Electric oil-immersed, water-cooled, single-phase transformers, connected delta-delta. These lower the pressure from 85,800 volts to 6600 volts. For improving the power-factor and regulation of the system duplicate synchronous condenser sets are provided, each consisting of a 6600-volt, fifty-cycle, 500-r.p.m., three-phase synchronous motor with a 125-volt exciter on the overhung part of the shaft. The motors are started up direct from the 6600-volt busbars through compensators, the starting current not exceeding full-load current. The total losses, including the power taken by the exciter, do not exceed 153 kw at full load and 167 kw at 20 per cent overload. The feeder distribution system from the receiving station to the mills is designed for a 6600-volt, three-phase supply with an unearthed neutral. The mills are arranged in groups, each group having a feeder to each mill, with an emergency ring feeder connecting up all the mills of the group. Group driving with directly coupled motors was adopted as being best suited to the requirements of the Bombay industry. Standard speeds of 265, 290 and 365 r.p.m. were adopted. The motors are of the three-phase, fifty-cycle, slip-ring induction type, wound for 2000 volts. The

present electrification contract covers thirty mills, with 199 motors, aggregating 37,525 hp. The power requirements of individual mills range from three motors, aggregating 325 hp, to nineteen motors, totaling 2400 hp.—London *Electrician*, April 30, 1915.

Traction

Electric Traction on Trunk Railways.—W. S. MURRAY.—A long paper discussing the conditions which affect the success of main-line electrification, with numerous diagrams and tables of cost from operation in practice.—*Journal Franklin Inst.*, May, 1915.

Installations, Systems and Appliances

Electrical Industries of Russia.—P. GUREWITSCH.—The author emphasizes the point that in Russia the electrical industry has made more rapid progress than has any other industry. The imports of electrical products into Russia were $2,200,000 in 1904 and $12,600,000 in 1913. The total imports of finished metal products of Russia were $48,000,000 in 1904 and $130,000,000 in 1913. In the last ten years the imports of electrical products into Russia, therefore, increased about five and one-half times, whereas the imports of other finished goods of metal increased only two and one-half times in the same period. At present 225 Russian towns have central stations. Four Russian cities (Petrograd, Moscow, Lodz and Baku), which have the largest electricity-supply plants, consumed 379,000,000 kw-hr. in 1913, while during 1905 all the Russian central stations supplied only about 500,000,000 kw-hr. It is thought that when the war is over the electrical industry in Russia will make very rapid progress as there are only twenty gas plants in the empire. In view of the large electrical developments expected, the question is asked whether Russia can produce the necessary electrical plant, machinery and apparatus. While this may be possible in the case of cables, telephone and telegraph apparatus and storage batteries, it is certain that Russia would have to rely on imports from other countries for all other requirements of the electrical industry. The chief import, as well as value and weight, concerns heavy machines of over 500 kg. In 1913 the exports of electrical machines to Russia were $16,000,000 from Germany, $11,000,000 from England, $7,000,000 from the United States, and $4,000,000 from Switzerland.—London *Electrician*, April 30, 1915.

Electrophysics and Magnetism

Arc in Longitudinal Magnetic Field.—R. F. EARHART.—An abstract of an American Physical Society paper. Using both cored and solid carbons, some experiments were made with a carbon arc in a uniform magnetic field. The lines of magnetic force were parallel to the axis of the carbon electrodes. The effect of establishing fields varying up to 2000 c.g.s. units was to reduce the current and to increase the potential difference between the terminals. The behavior was studied by determining the characteristic curves for the arcs with fields of different strength. The characteristic curve produced when the field is established is similar to one which would be obtained by lengthening the arc. It was noticed that the heat developed at the positive carbon was increased when the field was established. In such case an increased length of carbon became red hot. This indicated that the anode fall in potential had been increased, and such was found to be the case when an exploring electrode was introduced. The cathode drop was increased, but the anode drop had a greater relative increase than the cathode drop. The instability of the arc is increased with the application of the magnetic field. Unequal consumption of the carbon tips causes considerable difficulty.—*Phys. Review*, April, 1915.

Corona.—DONALD MACKENZIE.—An account of an experimental investigation of the corona in air at continuous potentials and at pressures lower than atmospheric. With respect to the positive effect the following results were obtained. All of the wires, when positive to the tube, formed coronas at the lowest pressures to which the apparatus was evacuated. The discharge is a perfectly uniform and stable violet or bluish glow extending the whole length of the wire. As the voltage is raised above that necessary to start the corona, the luminous sheath expands progressively, accompanied by an increase in the current. With further increase in voltage a point is reached where the corona is unstable. A slight increase in voltage causes the corona, previously uniform over the whole length of the wire, to collapse to a vacuum-tube discharge confined to a few millimeters. With respect to the negative effect the results were as follows: For the larger wires used the negative corona was not obtainable; the first detectable discharge was the vacuum-tube discharge. For the smaller wires the case was different. At the lowest pressures the vacuum-tube discharge is the only one obtainable. At higher pressures the negative corona appears, expands with increase of voltage above the critical value, and gives place to the negative vacuum-tube discharge at a transition point determined, as in the positive effect, by the pressure and the wire diameter. The negative corona is never a uniform sheath like the positive. It is grouped about bright blue points set at intervals along the wire. These blue points are surrounded by reddish streamers and increase in number as the voltage increases. The ratio of the critical voltages for the positive and negative corona on a given wire varies with the pressure. A pressure exists at which the two critical voltages are equal; below this pressure the negative critical voltage is lower than the positive, at higher pressures the positive corona-forming is the lower. The corona rectifies an alternating current, the direction of the rectified current depending on the voltage and the pressure.—*Phys. Review*, April, 1915.

Ultimate Magnetic Particle.—K. T. COMPTON AND E. A. TROUSDALE.—For many years the magnetic properties of bodies have been ascribed to the action of exceedingly small elementary magnets, but the nature of these ultimate magnetic particles has remained an open question. The author made some experiments to decide whether these fundamental particles are molecules or smaller. His results show conclusively that the ultimate magnetic particles must be atoms or something within the atoms, and are therefore consistent with the electron theory of magnetism, but not with the molecular theory. The ultimate magnetic particle cannot be a molecule or other group of atoms.—*Phys. Review*, April, 1915.

Electrochemistry and Batteries

Cyanamide.—FRANK S. WASHBURN.—A long paper on the cyanamide process in comparison with other processes for the fixation of atmospheric nitrogen.—*Met. and Chem. Eng'ing*, May, 1915.

Units, Measurements and Instruments

Measurement of Air Velocity by Hot-Wire Anemometer.—LOUIS VESSOT KING.—The author formerly developed the theory of the convection of heat from small cylinders cooled by a stream of fluid and applied it to the development of a precision anemometer intended for the study of the complex problem of gas-flow. In the present paper specifications relating to the construction of the linear hot-wire anemometer are given in detail. By means of the Kelvin double-bridge connections it is possible to employ wires at high temperatures, thus making velocity determinations practically independent of ordinary fluctuations of room temperatures. Applications of the hot-wire anemometer to physical and technical problems are described.—*Phil. Mag.*, April, 1915.

Coefficients of Self and Mutual Induction of Coaxial Coils.—S. BUTTERWORTH.—A highly mathematical paper in which the author gives formulas for the self-induction and mutual induction of coaxial circles and solenoids for which the ratio of the inner and outer diameters differs considerably from unity.—*Phil. Mag.*, April, 1915.

Telegraphy, Telephony and Signals

Wireless Telegraphy.—FRACQUE.—In continuations of his long serial on the mathematical theory of wireless telegraphy, the author takes up the mechanism of the production of trains on oscillations in a condenser circuit and then discusses the use of additional apparatus required in wireless telegraphy.—*La Lumière Elec.*, March 13 and 20, 1915.

Battery-Bell Signaling Systems and Their Dangers.—A British "white paper," issued by the Home Office, embodying a report by R. V. Wheeler (of the Experimental Station, Eskmeals) on the results of experiments undertaken by him to establish a system of bare-wire signaling free from the risk of igniting firedamp-air mixtures in coal mines. The conclusions are stated as follows: "All the bells examined were capable of producing a highly dangerous break-flash at the signal wires when used with a battery of ten wet Leclanché cells, the voltage being 15. The break-flash was still more dangerous when a battery of ten dry cells was employed, since the current available from them is considerably greater than that obtainable from wet Leclanché cells. In general, the bells examined were 'overpowered.' A single bobbin with a reduced number of layers of wire was found in several cases, when fitted to the original bell frame, to actuate the bell as efficiently as is required in practice. The use of only one bobbin (that is, a bar electromagnet) with a small number of layers of winding reduced the self-induction of the circuit and thereby decreased the danger of the break-flash at the signal wires. Inasmuch as the voltage is relatively of little importance compared with that of the current strength, so far as the safety of the break-flash on the signal wires is concerned, it is desirable that attention should be directed toward not exceeding a certain maximum number of cells in the battery, rather than that care should be taken not to exceed a certain voltage. Moreover, it is desirable that a cell of comparatively high internal resistance, such as the wet Leclanché cell, should be employed, so as to avoid the possibility of obtaining large currents on short-circuiting the battery. Taking as a standard battery ten wet Leclanché cells, quart size, such as are commonly used for battery-bell signaling systems, giving a voltage of 15 and a maximum current on short-circuiting of about 1.5 amp, it is possible so to modify the usual pattern of bell as to render the break-flash at the signal wires safe in the most sensitive methane-air mixture, without impairing the ringing power of the bell. This can be done in several ways, of which the simplest probably are: (1) By the introduction of a non-inductively wound resistance coil in series with the magnet coils such that it will reduce the current available at the break-flash below the minimum igniting current: (2) by increasing the resistance of the magnet windings of the bell by the use of wire of fairly high resistance, such as brass wire, for the same purpose as in (1); (3) by the use of parallel winding, and (4) by the use of tinfoil strips between the layers of winding in the manner and for the purpose already described. Of these four methods the third may be open to the objection that should the short-circuited winding be accidentally broken the bell might become unsafe."—*Iron and Coal Trades Review* (London), April 23, 1915.

Book Reviews

EXPORT TRADE DIRECTORY. New York: The American Exporter. Compiled by B. Olney Hough. Price, $3.

This directory contains a complete list of the export commission houses, foreign buyers, manufacturers' export agents, foreign exchange banks and bankers, marine insurance companies, export truckmen, and foreign freight forwarders in all the principal United States ports; also of foreign consulates in the United States, American consulates abroad, and other valuable information of interest to manufacturers who wish to establish foreign trade relations.

METAL STATISTICS, 1915. New York: The American Metal Market and Daily Iron and Steel Report. Price, 50 cents.

These statistics show care in compilation and will be found valuable for buyers and sellers as well as for plant managers and engineers. In the present volume some additional statistics have been included in the production of coal, petroleum and cement. The tables on United States copper production for 1914 showed the production of copper to have been 1,129,000,000 lb., a decrease of 7.8 per cent, and the consumption for 1914 was estimated at 570,000,000 lb., as compared with 767,351,760 lb. in 1913. The remarkable increase in the production and consumption of aluminum may be noted by the fact that, in spite of the unusual conditions prevailing, the past year showed a consumption of approximately 60,000,000 lb., as compared with 8,600,000 lb. in 1904.

PRINCIPLES OF INDUSTRIAL ORGANIZATION. By Dexter S. Kimball. New York: McGraw-Hill Book Company, Inc. 272 pages. Price, $2.50.

The purpose of the author is to set before young men entering industry the salient facts regarding the most important movements with which they will come in contact and to explain the origin and growth of industrial organization. The text is based on lectures given by Professor Kimball to the senior class in the Sibley College of Mechanical Engineering, Cornell University. Beginning with the early development of industry, the author outlines inventions that effected industrial revolution. Following these came various reform methods, causing freer distribution of the increased wealth created by economical production. The most important of modern industrial tendencies are said to be increase in size of enterprises, specialization of enterprises and men, standardization, and extreme division of labor. Included in the wide scope of ensuing chapters are such important subjects as system, the planning of department work, cost-keeping, depreciation, labor compensation, purchase and care of materials, and selection of location, arrangement and construction of plants. The résumé of the concluding chapter, dealing, it is true, with theories, is a warning to the novice. If the one who embarks in an enterprise is to be successful, he must be versed in financing, manufacturing and selling, and his chances rest on monopoly, quality or price. The author has done a needed service in setting forth these facts plainly.

Book Received

Proceedings of the American Electric Railway Engineering Association, 1914. Published by the American Electric Railway Association, from the office of the secretary, 29 West Thirty-ninth Street, New York. A complete report of the twelfth annual convention of the American Electric Railway Engineering Association. 596 pages. Price, $3.50.

POWER AND OPERATING SECTION

Storage Battery Serving Combined Alternating-Current and Direct-Current System

Existing load and substation conditions on the system of the Commonwealth Power Company, Milwaukee, Wis., have enabled that corporation to install a storage battery capable of carrying both the alternating-current and direct-current load of the system for twenty minutes. All of the company's direct-current load, approximately 300 kw, is furnished from the Alhambra substation. The total maximum alternating-current load on each of the company's three substations is given below:

	Kw
Alhambra	200
Majestic	300
Auditorium and pole transformers	180
Total alternating-current load	680

Since the battery is situated in the Alhambra substation, from which all of the direct-current load of the system is supplied, the battery is floated directly on the direct-current buses ready to take up the load at any time. Under ordinary operating conditions direct current is supplied to the system by two motor-generator sets. The first of these sets consists of a 2200-volt, three-phase, sixty-cycle, 89-amp synchronous motor directly connected to a 240-volt, 300-kw flat-compound, two-wire, direct-current generator. The other motor generator set consists of a 2200-volt, three-phase, sixty-cycle, 61.7-amp synchronous motor driving a 240-volt, 200-kw flat-compound, two-wire generator. Both sets operate at 600 r.p.m. As will be seen from the simplified wiring diagram, the battery floating on the direct-current buses stands ready upon failure of the alternating-current source to motor the direct-current machine and thus supply alternating current from the motor-generator sets. At the same time the battery picks up the direct-current load which had formerly been supplied from the direct-current generators.

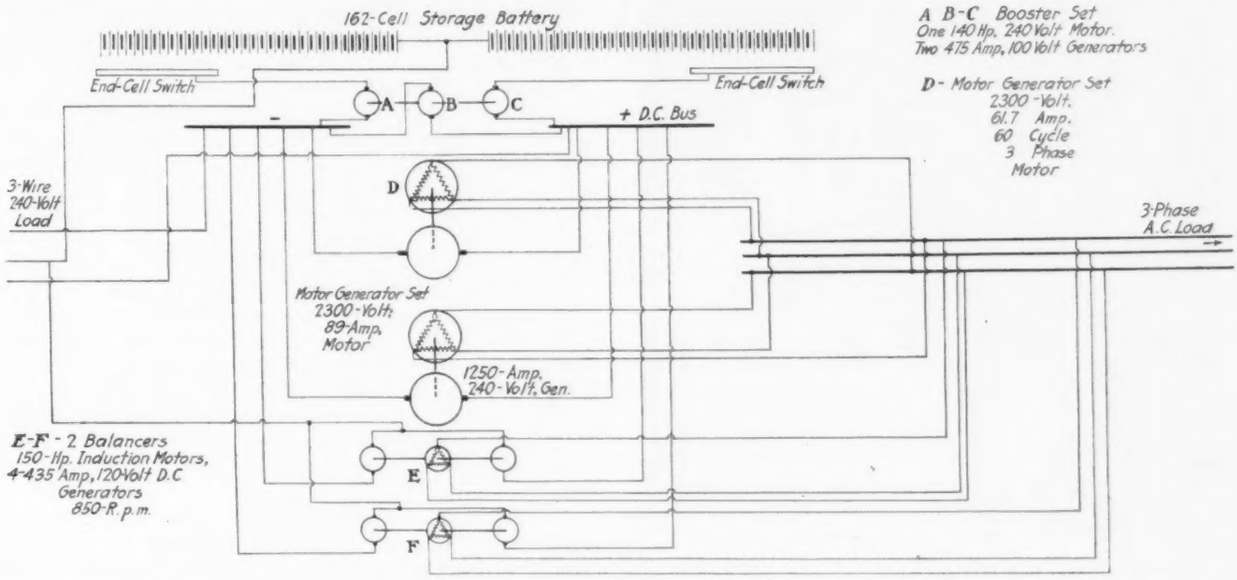


FIG. 1—DIAGRAM OF CONNECTIONS OF BATTERY ARRANGED TO SERVE BOTH ALTERNATING-CURRENT AND DIRECT-CURRENT SYSTEMS

The battery itself consists of 162 cells with lead-lined wooden tanks resting on porcelain oil-filled insulators and porcelain pedestals. The installation is

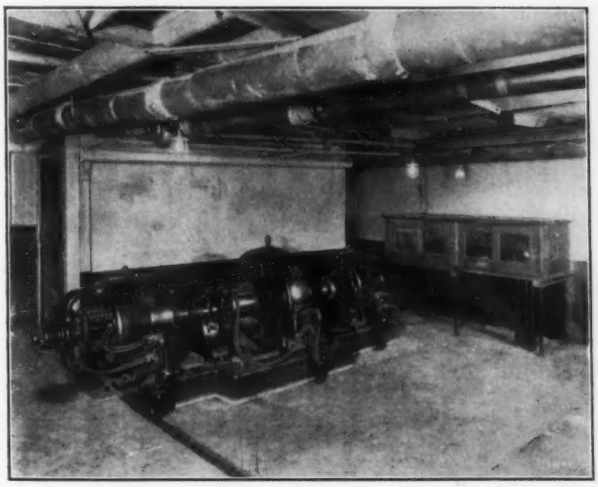


FIG. 2—BATTERY BOOSTER AND END-CELL SWITCH

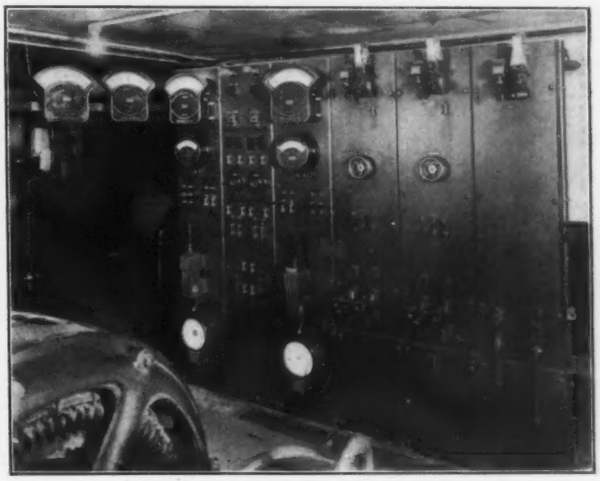


FIG. 3—DIRECT-CURRENT SWITCHBOARD

capable of delivering approximately 600 kw continuously for one hour at 240 volts, or 1264 kw for twenty minutes at 240 volts.

Arrangements have been made so that fifty-four cells may be cut in or out of service, by means of end-cell switches, as voltage conditions require. Each end-cell switch has its points arranged for seven single-cell connections, one two-cell connection and five three-cell connections, providing for an addition of twenty-four cells to each side of the system. This, it was estimated, will allow the station operator to maintain full voltage on both the alternating-current and the direct-current system for the entire twenty minutes.

FIG. 4—AN AISLE IN THE BATTERY ROOM

The battery is charged from the standard bus potential of 240 volts, energy being conducted through a three-unit booster set consisting of one direct-current motor driving two direct-current generators. In this way the potential of each booster generator is added to the normal bus voltage in order to obtain the proper potential for charging the battery.

Atlantic City's Varying Load-Factor

The permanent population of Atlantic City, N. J., is 54,000, but for a period of about six weeks during the summer the great influx of visitors increases the number to a maximum of 300,000, making the average population for the entire year about 96,000. In consequence of this fluctuating population of "the city by the sea" the 10,000-kva generating station of the Atlantic City Electric Company carries its maximum load of 6600 kw on only fifty or sixty nights of the year, enjoying a day load of about 1000 kw during this period. For the remaining ten months of the twelve the maximum load on the station reaches only 2500 kw, with a day load of 650 kw.

As there are few manufacturing plants at Atlantic City, central-station energy is used almost entirely for lighting and display purposes. The lighting load is, however, unusually long-hour in character, the summer peak beginning about 7:30 p.m. and continuing until nearly midnight.

The Unaccounted-for Loss

BY S. U. TUSPIN

In every efficiency test of a steam boiler the percentages of the heat value of the fuel used in evaporating water and lost in various ways are tabulated. The larger part of the heat developed by the combustion of the fuel is absorbed by the boiler, and this percentage represents the useful effect. The object of every owner and power-plant manager is to raise this value, for the simple reason that he wants to obtain the maximum of return for his investment in fuel.

In the operation of a boiler plant, however, losses are unavoidable. The escape of hot gases up the chimney produces a loss of heat; for it is not feasible to absorb so much heat from the flue gases that they will have only the temperature of the boiler room when they escape. Moreover, if natural draft is used, the chimney gases must have a temperature sufficiently higher than that of the surrounding air to produce the required pressure difference and maintain the draft. Heat must therefore be lost through the hot gases in the chimney.

Some of the Assignable Losses

The hydrogen contained in the fuel burns to water; but under the effect of the high temperature existing in the furnace this moisture is converted into highly superheated steam, which gives up only a part of its heat in passing over the heating surfaces of the boiler. The latent heat of vaporization of this steam and the heat required to superheat it to the temperature of the chimney gases are lost when it escapes to the atmosphere.

Another way in which loss may occur is through incomplete combustion of carbon, by which is meant the failure of the carbon content of the fuel to be thoroughly oxidized. If the carbon is not completely burned to carbon dioxide, the escape of part of the combustible material as carbon monoxide in the flue gases will represent a loss of some heat that should have been developed in the furnace or in the combustion chamber.

Again, radiation of heat from the boiler setting forms another way in which some of the heat is lost, although, in comparison with the other losses already mentioned, this one is small. Besides, there is the loss of potential heat in the particles of unburned coal that fall through the grate into the ashpit and are removed with the ashes. With fine coal and careless firing the loss in this way may become large.

Definition of the Term

However, if the percentages of these various losses are estimated from the observations and calculated results of the test, their sum will not be 100. In other words, there will be a discrepancy between the total heat value of one pound of the coal used and the sum of the heat units lost and utilized in evaporating water. The difference, expressed either in heat units or as a percentage of the total heat value of the fuel, is called the unaccounted-for loss, because there are no definite and positive ways in which the loss can be explained.

Of course, the mere fact that all these other losses are combined under the head of the unaccounted-for loss does not mean that there has been no attempt to discover how they are distributed and to what they are due. As a usual thing, however, the observations taken during a boiler trial are of such nature that only the following items are readily calculable:

(1) Heat absorbed by the boiler.

(2) Heat lost due to moisture in the coal.

(3) Heat lost due to the moisture formed by the combustion of hydrogen in the coal.

(4) Heat lost in the escape of dry flue gases.

(5) Heat lost due to incomplete combustion of carbon.

It will be observed that this list does not include the radiation loss. As a consequence, the radiation loss and all other losses are grouped together in a sixth item, which includes all the losses not otherwise mentioned.

Moisture of the Air a Factor

One of the factors in the unaccounted-for loss is the moisture in the air supplied to the furnace. Atmospheric air contains more or less moisture in the form of water vapor. In cold, dry weather the amount of vapor present in a cubic foot of air is much less than in warm, rainy weather; therefore the amount of moisture carried into the furnace by the air supply varies not only according to the amount of air admitted but also according to the humidity of the air. This moisture, which exists as a vapor and is under atmospheric pressure, is superheated in the furnace and passes out to the atmosphere as a superheated vapor at the temperature of the chimney gases. The loss in this way is equal to the amount of heat required to superheat the water vapor from the temperature of the entering air to the flue-gas temperature. The amount of heat thus lost may, under particularly adverse conditions, be as great as 1 per cent of the heat value of the fuel.

Another part of the unaccounted-for loss may be due to the evaporation and superheating of moisture deliberately added to the fuel. When the fuel used is finely divided, such as bituminous slack or the lowest grades of anthracite, it is the usual practice to wet down the coal before it is fired. The water causes the grains to stick together and reduces the loss due to the dropping of unburned particles through the grate. But such moisture is added after the coal is weighed, and when it is converted into steam in the furnace and allowed to escape with the flue gases as superheated steam it carries with it the heat that has been required to change it from moisture at the temperature of the fuel to superheated steam at the temperature of the flue gases.

Wetting May Increase Efficiency

The efficiency of the combustion may be so increased by wetting down the coal that the loss due to the heat in the water may be more than compensated; but the escape of that heat should undoubtedly be considered among the factors composing the unaccounted-for loss. The same is true of water that is sprayed over the ashes in the ashpit and that is evaporated and carried up through the furnace. Again, the practice of blowing steam under the grate to prevent clinkering adds another element to the unaccounted-for loss, by reason of the sensible heat carried off by that steam.

The removal of hot ashes results in a loss of heat that may properly be included in the unaccounted-for loss. The amount of heat thus lost is the product of the weight of ashes, in pounds, the specific heat of ashes, 0.16, and the temperature of the ashes above that of the boiler room, in degrees Fahrenheit.

The carbon that is deposited on the heating surfaces of the boiler as soot, or that collects in other parts of the gas passages, forms a part of the unaccounted-for loss; but the amount of heat thus lost is very small. The same may be said of the carbon particles that escape up the chimney and give color to the smoke.

A further part of the unaccounted-for loss may be due to the escape of unconsumed hydrogen or hydrocarbons in the flue gases; but the determination of the percentages of these gases in the products of combustion is not easy, and it is therefore a difficult matter to calculate the losses due to them.

To indicate the relative importance of the various losses, the subjoined table is given. The values, of course, are not absolute but are intended to indicate approximately the distribution of the heat in the fuel:

	Per Cent
1. Heat absorbed by boiler	50 to 75
2. Loss due to evaporation of moisture	4 to 6
3. Loss due to escape of hot flue gases	15 to 35
4. Loss due to radiation	2 or more
5. Loss due to unburned carbon in ash	1 to 10
6. Loss due to CO in flue gases	0 to 5
7. Loss due to removal of hot ashes	0.3 or less
8. Loss due to carbon in soot	0.2 or less
9. Loss due to unburned hydrogen and hydro-carbons	Slight

However, if all the expenditures of heat are calculated as closely as possible and their sum is taken, it is found that there still remains perhaps 10 per cent of the heat value of the fuel for the disappearance of which there seems to be no satisfactory explanation. It has led to much conjecture and discussion, but without definite result. The one point that has been established is that a low unaccounted-for loss is always accompanied by a high boiler efficiency. Consequently, if the known and approved methods of obtaining efficient boiler performance are conscientiously followed, the unaccounted-for loss will be reduced to a low figure without the necessity of considering its items separately.

Guards and Grill Flooring for Generators and Rotary Converters

Shown in the accompanying illustrations are rotary converters equipped to prevent accidents either to the machine attendant or to persons passing the machines. A grill flooring has been laid in the central opening in the frame bedplate to prevent anyone falling therein. The grill also serves as an insulated platform on which the operator can stand while cleaning the commutator. The wire cage boxing in the slip-rings and commutator

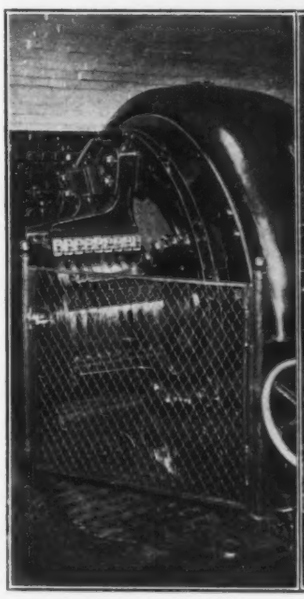


FIG. 1—CAGE FOR COMMUTATOR END OF ROTARY CONVERTER

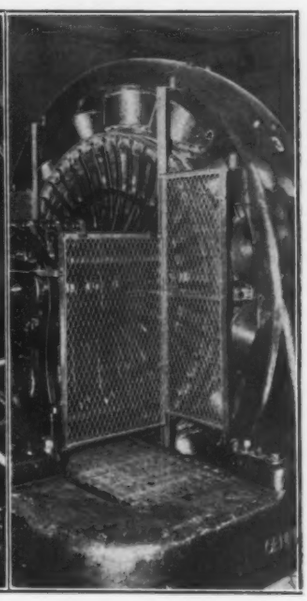
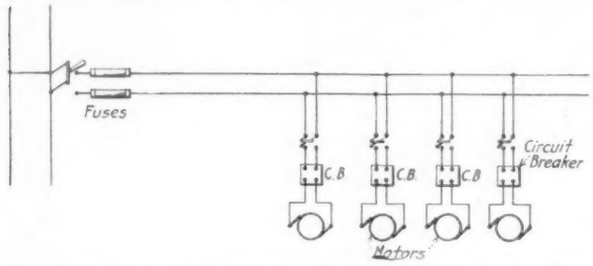


FIG. 2—CAGE FOR SLIP-RING END OF ROTARY CONVERTER

end of the machine is to prevent persons touching or coming in contact with energized conductors. This equipment has been adopted by the Edison Electric Illuminating Company of Brooklyn after carefully investigating a number of other schemes. The screen and flooring can be adapted to motors, generators and rotary converters.

Individual Circuit-Breaker Protection Used for Motors

Having experienced considerable annoyance owing to the fact that overloads on individual, fuse-protected, direct-current motors connected in parallel to a pair of mains protected by a circuit-breaker often opened the circuit-breaker, and thus shut down the plant, the engineers of an industrial plant near New York City recently made the following changes in its layout:

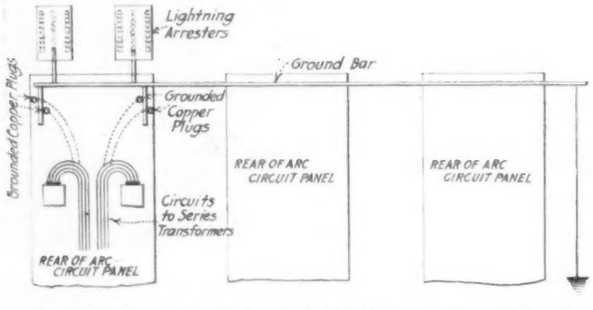


MAIN FUSES USED WITH INDIVIDUAL CIRCUIT-BREAKERS

The fuses protecting the individual motors were removed and circuit-breakers substituted, while the circuit-breaker protecting the mains was removed and fuses were installed. In this way a time element in the operation of the protective device for the mains was introduced, while the protection provided for the motors was rendered instantaneous. Therefore, when a motor is now subjected to a severe overload, only the circuit-breaker opens and the remainder of the plant is not affected.

Special Apparatus for Grounding Arc-Lamp Circuits

Along the tops of the switchboard panels which serve several recently installed constant-current arc-lighting transformers at Indianapolis, Ind., Mr. A. J. Goedjen, electrical engineer for the Merchants' Heat & Light Company, has caused an unusual grounding arrangement to be installed. Primarily, this special apparatus is a ground bus, to which the switchboard frames, switch inclosures, lightning arresters and transformers are connected. At the rear and near the top of each board connected to this bus there is, however, still another device consisting of a pair of copper plugs protruding horizontally from copper bases. These plugs were placed in this position so that the outgoing leads from the line switch might be grounded without difficulty in case a lineman was sent on the line to work or to clear line trouble. The plugs on the back of the board are identical in size with those in the line switch so that the ground connection can be made by pulling the leads out of the switch and pushing the socket to which they are soldered over the copper ground plugs.

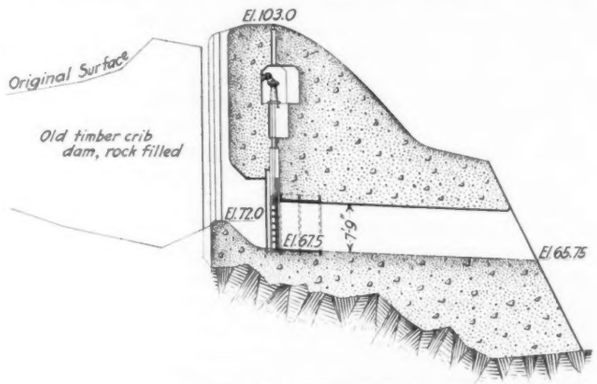


PROVISION FOR GROUNDING ARC-LAMP CIRCUITS AT SUBSTATION

Protecting Flashboards by Regulating Gates

To be able to carry flashboards on top of a dam without losing them every time there is a small rise in the Connecticut River, the Turners Falls Power & Electric Company, Turners Falls, Mass., has installed regulating gates as shown in the accompanying drawing. There are six 8-ft. by 7-ft. 9-in. cast-iron sluicegates in the half of the dam next the headgate. Each gate weighs about 3.5 tons and admits water into a sluiceway in the dam as illustrated. It is provided with a 4-in. Tobin bronze stem carried up through a stuffing box to hoisting mechanism in a tunnel in the dam. The gates are raised by a 20-hp, 220-volt, three-phase, sixty-cycle Allis-Chalmers induction motor running at 850 r.p.m. and chain-connected to a countershaft, the latter being belted to a second counter, which in turn is geared to a horizontal line shaft running through the tunnel. The line shaft is 121 ft. long, and the distance from the first gate to the end of the shaft is 36 ft. Each gate can be opened wide in twenty minutes.

The company found in trying to carry 5 ft. or 6 ft. of flashboard on top of the dam that the structures were frequently carried away in sudden rises in the river,



DAM AND HEADGATES

causing a loss in head and reduction in power output, there being comparatively little storage above the plant. By carrying the flashboards to a height of 5 ft. or 6 ft. the company can hold back enough water to tide over temporary disturbances in the flow which may be caused by the operation of plants above Turners Falls or by demands on the local station. One of the chief advantages of the gate installation is the flexibility with which extra level may be utilized in cases where the flashboards are carried away. Thus, if there were no gates of this kind and the flashboards were stripped, it would be necessary to wait until the amount of flow was so small that the regular draft for power would pull it down to the crest of the dam, when the boards could be replaced. Now, however, as soon as the flow is reduced somewhat, the gates can be opened, the pond lowered to the crest of the dam, the flashboards put on, the gates closed, and the pond allowed to fill.

Change in Draft Control Effects Economy

The automatic damper control apparatus in the plant of the Middletown (Ohio) Gas & Electric Company has been altered so that instead of acting upon dampers at the breeching entrances it actuates dampers in the ash doors. Thus, instead of stopping merely the rush of gases up the flue, the dampers as they are now operated stop the inrush of air to the fires. Mr. L. C. Anderson, treasurer and manager of the Middletown company, reports that the change has effected a saving in coal and improved operation of the hand-fired boilers.

COMMERCIAL SECTION

The Buyers of To-morrow

THE children of to-day will be the buyers of to-morrow. The opinions they form while young will cling to them for years. What impressed them and appealed to them while in the educative period will probably habitually appeal to them as men and women, and it is important that we give more serious attention to the opportunities for reaching the rising generation through the schools. In many high-school domestic-science classes electrical appliances are used for cooking. It were well, if it be possible, to carry the thought a little further and make the electric suction sweeper, the electric washing machine and electric kitchen motor outfits the medium for further instruction in the practical mechanics and efficiencies which must continue to play so large a part in the business of housekeeping. The trend of the times is in this direction, and the industry should take advantage of it.

Looking for the Obstacle

IT is said to be a rule among the salesmen of a certain large manufacturing company which sells its product to small retail merchants that in every case where a prospective customer refuses to give his order the salesman shall delve deep until he finds the reason. Experience has shown that in the majority of cases the obstacle will prove to be not unsurmountable if the salesman and the merchant can put their heads together in a search for the solution of the problem. In almost every case the merchant wants to buy, and his reluctance can usually be traced either to some past experience that has bred prejudice or to financial complications of some kind which the salesman can often promptly aid in relieving. The electrical contractor and the central-station salesman in their dealings with the householder can apply this policy to very good effect, for anything that makes for frank discussion and thorough confidence will strengthen the chances for the sale.

Co-operative Buying

WITHIN the last few months presidents of several state electrical associations in their annual addresses have suggested co-operative buying for central-station companies as a possible function of the associations. No case comes to mind, in this country at least, where a scheme for carrying out such work has been actually outlined. In all probability such a plan could be worked out so that its operation in some respects might be satisfactory. But from other standpoints it seems that such an arrangement could bring hardly anything but trouble to the association which fostered it. It is the function of state electrical associations to bond together men in the same business by ties of friendship which are most readily formed in the "vacation atmosphere" which pervades convention assemblages. It is the function of these associations to provide for and to bring out discussions so that men may acquire ideas, learn what others are doing, and hear how others are solving their problems. But it is difficult to conceive of a state electrical association acting successfully as the purchasing department for its member companies.

Restoring Dead Services

IN connection with the attention which is now being given by many electric-lighting companies to the restoration of dead services, it is interesting to note to what a surprising extent it is possible to win back to active production this expensive, idle investment. One can hardly realize how rapidly conditions change and how often customers who for one reason or another were forced to discontinue service can be resold within a comparatively short time. Yet, if left to return to activity through the initiative of the customer himself, the majority of these dead services will stand non-productive for an indefinite period. The alluring prospect of new business has too often diverted the attention of the salesman away from the business that has been lost. And this in spite of the fact that the re-connection of dead services offers a far more profitable opportunity than an equal or even greater load where every new connection necessitates a further investment. The experience of these recent campaigns for the restoration of dead services has proved that it is far easier to win such business back than has generally been assumed.

Appliance Repairs

THE electrical supply dealer or central station maintaining a liberal policy with respect to making minor repairs on appliances quickly and, as far as possible, at practically no cost to the consumer, builds up popular good will at a surprising pace. No doubt this policy is often imposed upon, but in most cases it is worth all that it costs to keep the public contented and the apparatus in steady service. No one can estimate the amount of lost revenue from appliances stored away on pantry or closet shelves for lack of some trifling replacement or adjustment which would at once turn them into income producers. The supply man who is long-sighted knows that even if he spends an hour or two some busy forenoon repairing an electric flatiron which has been abused, let us say, in institutional service, he is pretty likely to gain in the end.

The Influence of the Individual

A natural habit of most men is to free their minds from business and to try to get away from thoughts of work in hours of recreation. It is an entirely proper attitude, and every wise employer appreciates that all work and no play makes for poor efficiency; but at the same time there is a personal influence which every central-station employee can contribute, without the slightest tax upon his mind or his time, and which will be of very far-reaching benefit for his company. The sales manager of a Middle Western central station recently made the statement that scarcely a day goes by without several persons coming to the office of that company to look at household appliances, as a direct result of the personal influence of the general manager of that company. This general manager makes it his custom to take advantage of every opportunity to interest his friends and acquaintances in the many modern domestic applications of electricity. Consider what the influence would be if every one of the hundreds of employees of that company were practising this policy in the same degree. It is all a habit, the outgrowth of a mental attitude that assumes responsibility at every point and every hour, so that it becomes the most natural thing in the world, as each convenient occasion presents itself, to grasp the opportunity to make a new friend for the company, to overcome a bit of thoughtless prejudice, or to increase the popularity of the service. Probably most central-station employees believe that they are doing this to-day, but there is a difference between mere loyalty that rises to defend the company from attack and an eager, watchful ambition to strengthen the company commercially by the constant pressure of one's personal influence. It is a habit, and when the habit is once formed it operates quite automatically and to great benefit and satisfaction.

The Jobber and the Price

One of the most urgent and important issues before the industry to-day is the never settled question of the jobber and his policy. Should the manufacturer sell in competition with him and should the jobber handle cheap substitutes for standard material made by manufacturers who refrain from entering his market? It is hard indeed to lay down any ruling on the ethics of the case that does not interfere unjustly with personal liberties, but there is one basis of consideration that sheds much purifying light and has been too little thought of. It is the all-controlling factor of quality, the fact that in every man's mind the weighing of the cost comes second to the test for quality. No matter what he buys, each time he asks himself the question, "Is it fully worth the price?" In other words, he is more eagerly intent on securing the very best quality for the price than on paring down the cost of the quality which he is buying. There is a difference here in mental attitude that is important as a market influence.

Price must ever govern quality just as quality governs price, and the cheaper line that is sold direct to the consumer, in competition with the standard goods the jobber offers, is not worth more than it costs. This the public understands in theory but forgets too often in the dazzling presence of what seems to be a bargain. It is here that the jobbers and the manufacturers who do not sell directly to the ultimate consumer should concentrate the pressure of their educational work. The world is learning fast to make this test for quality, and the answer to many of our market problems comes with it.

The jobber offers a service that cannot be duplicated by the manufacturers acting singly. Moreover, it costs the manufacturer quite as much to market goods at retail as it does the jobber, quality for quality. The jobber's opportunity, therefore, lies in the line of education, for when the buyer habitually appreciates that quality determines price, no matter who the seller, the situation will purge itself.

Eliminating Unwired Houses

In Schenectady, which contains about 75,000 inhabitants, only 417 of 18,000 houses are unwired. Credit for introducing electric service in all of these houses, however, is not claimed by the officers of the local central-station company, who declare that the condition is the result of an "electrical atmosphere," so to speak, arising from the city's being a great electrical center. Being brought in contact every day with persons connected with the electrical organizations situated in that city, or else reading of electrical subjects in the newspapers, the people have instinctively grown to desire electric service and have demanded it. As a result real-estate owners have been compelled to supply the facilities for making use of central-station service.

Similar conditions can be created by educational campaigns. Billboard and electric-sign publicity, newspaper articles, educational motion pictures shown in the companies' buildings, advertising on anything that reaches a large number of people and is preserved by them, demonstrations of appliances in homes, window displays, etc., all help to create a demand for electric service. If this demand is met by conservative rates, good service and courteous treatment of the public, any local company should be able to connect as great a proportion of the houses in its territory as has the Schenectady company.

Already the revenue per capita for residence service alone in Schenectady is $6.63 per year, which is probably as high as for any other city in the country. Under these conditions, after household appliance sales and lighting campaigns have ceased to show appropriate returns, probably electricity can be sold at an attractive rate for heating water and cooking. By combining the latter an ideal load can be secured when served on the flat-rate basis. A relatively low rate will have to be offered, but it need not necessarily be below the unit cost of supplying similar service with coal, because the consumers can easily be shown that electric energy is more convenient and sanitary than coal fuel.

A Year of Sales at Providence, R. I.

Summary of the Commercial Achievements of the Narragansett Electric Lighting Company, with Details of the Methods Employed

THE sales department of the Narragansett Electric Lighting Company, Providence, R. I., has compiled data covering its operations in 1914, the most successful year in the company's history. The total new business secured during the year gives the company an estimated increase in annual revenue of $225,037. The net cost of securing this business, including all expenses of the department, was $33,895, or 15 cents per dollar of additional revenue per year. New business obtained in the lighting division totaled $109,942, at a cost of 10.8 cents per dollar; in the motor-service division, $101,649, at 11.8 cents per dollar, and in the appliance division, $13,446, at a cost of 71 cents per dollar. Rent, postage, salaries, telephone, telegraph and all costs were included in these figures.

The Lighting Division

The net connections in the lighting division for the year totaled 4097 kw, a gain of 779 kw, or 23 per cent, over 1913. In the last four years the net gain has increased 193 per cent, or 2701 kw. The new contract business secured in this department covered 3651 contracts, aggregating 3493.2 kw, with an average income per contract secured of $28.63. Nine lighting installations varied from 12 kw to 30 kw in connected load, among these being the State Pier No. 1, 28 kw; Y. M. C. A., 30 kw; Emery Brothers' Theater, 25 kw, and the Armory of Mounted Commands, 20 kw.

In October, 1913, the company placed a new lighting rate in effect. This schedule, known as the "C" rate, employs a graduated scale and begins with a service charge of $120 per kw of maximum demand per year, plus an energy charge of 1 cent per kw-hr. for demands between 0.25 kw and 10 kw. The service charge gradually decreases to a minimum of $24 per kw per year for a demand of 200 kw and over, with an energy charge of 8 mills per kw-hr. The result of putting this rate into effect, on a yearly contract permitting the use of energy for all purposes, has been a remarkable increase in the use of electricity by establishments of the long-hour type, as shown in the accompanying table. This rate has proved a most successful means of attacking the gas "arc" in Providence and has increased the estimated annual income of the company by $15,710 since its adoption. During the year 209 installations where gas was used before have become exclusive users of electricity.

In 1914 the company increased its billboard installations to a total of fifty-six, and it is stated that Providence has more illuminated billboards in proportion to its population than any other city in the country. (Population, 1910 census, 224,326.) Auxiliary lighting con-

FIG. 1—AN INTERIOR VIEW THAT SHOWS HOW THE GOODS ARE DISPLAYED IN THE PROVIDENCE ELECTRIC SHOP

tracts were executed during the year with six manufacturing plants, the connected loads ranging from 0.9 kw to 19 kw.

Subsidence of Carbon Lamps

Last year was the first since the advent of the tungsten lamp in 1908 when the renewals of carbon lamps have shown a decrease over those of the previous year. The total number of carbon and miniature lamps renewed was 153,925, compared with 186,038 in 1913, and

EFFECT OF ADOPTION OF CONTRACT LIGHTING RATE

Kind of Business	Total Number in City	Before Adoption		After Adoption	
		Exclusive Users of Electricity	Percentage of Users to Total Number	Exclusive Users of Electricity	Percentage of Users to Total Number
Drug stores	151	16	10.5	74	49.0
Saloons	330	11	3.3	154	46.7
Bowling alleys	18	2	11.0	3	16.7
Restaurants	165	16	9.7	44	26.7
Garages	32	24	75.0	27	84.4

it is believed that this marks the beginning of a decline in the company's carbon-lamp business. The company is selling tungsten lamps at retail list prices and is renewing carbon lamps free. The total number of tungsten lamps sold in 1914 was 136,315, compared with 102,156 in 1913. During the "Edison Day" campaign in October 22,093 lamps were sold in one week. Prices were reduced 25 per cent for the period on 25-watt to 100-watt lamps, and all but the latter size were sold in cartons of five lamps each. Service was extended during the year into six suburban communities.

Industrial Motor Service

The net motor connections for the year were 4230 hp, or 76 per cent more than for the previous year and 41 per cent more than for the best previous year the company ever had. Included in the new business secured are the following: City of Providence's Pettaconsett pumping station, 1300 hp; Colored Worsted Mills, 360 hp; Davol Rubber Company, 800 hp; National Ring Traveler Company, 225 hp; Crown Hotel Company, 100 hp; New England Butt Company, 175 hp; Universal Winding Company, 120 hp; Household Cabinet Works, 128 hp; Interstate Stone Company, 173 hp; Manufacturers' Outlet Company, 100 hp additional, and others. Fourteen concerns discontinued isolated-plant service. The increasing motor load has improved the station load-factor materially, as last fall the station peak was only twice the day load, compared with nearly three times in previous years. Two carloads of motors were sold to customers by the company during the year, and the policy has been continued of selling motors on a lease and installing them free for trial service.

As a result of wide popularity of electric power, it is now frequently possible to obtain new power business without any formal report other than a one-page or two-page letter. The motor-service division has also been able to eliminate to a large extent the drawing of plans and specifications for equipment, although the form of report heretofore extensively used continues to be a valuable method of securing new business where the saving by central-station service is not large or where conditions are complex. Six electric refrigerating plants of from 5-hp to 20-hp rating were installed last year, the principal drawback to the installation of this class of service being the high first cost of the refrigerating machinery. The outlook for the year 1915 is very satisfactory. The growth of the connected motor load from about 900 hp in 1894 to 26,600 hp in 1915 is shown in the accompanying diagram.

Electric-Vehicle Development

During the year five new electric pleasure cars and fourteen commercial vehicles were purchased in Providence. The company's income from private charging plant energy supply was $843.49, the energy delivered being 16,253 kw-hr. Thirteen such installations are in service, and on the system as a whole there are now thirty-five passenger electric vehicles in operation. Last fall a local garage was induced by the company to exhibit an electric brougham at the Providence automobile show and to sign an agency agreement, and three electric vehicles have been sold as a result.

The largest purchase of electric commercial cars during the year was by the Outlet company, covering five 1000-lb. delivery wagons, two 1500-lb. furniture wagons, and a 2-ton freight truck. This fleet cost about $25,000, of which nearly $10,000 is invested in batteries. These are of the Edison type and are 50 per cent larger than

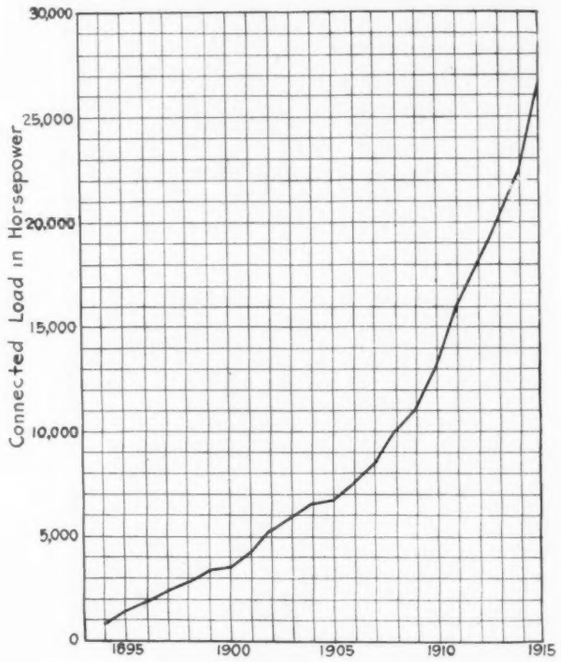


FIG. 2—GROWTH IN MOTOR LOAD AT PROVIDENCE

are generally used on such vehicles. They are to operate at from 12 to 14 miles per hour, according to load, and are of 65 miles estimated operating radius. These machines were purchased from the Commercial Vehicle Company, Philadelphia. The estimated annual consumption of energy of this fleet is 125,000 kw-hr.

There are now thirty-six electric commercial vehicles in the company's territory, besides seven owned by the central station. The total sales of battery-charging energy for pleasure and commercial vehicle service last year were $1,928.95, the energy requirements being 60,385 kw-hr., or an average of 3.19 cents per kw-hr. for all public and private garage service. The Narragansett company's expenditures have been limited to $150 for an exhibition of the Outlet company's delivery system at the Armory Show, together with a small amount of advertising.

Electric Appliances

The company's Electric Shop sold 3838 appliances in 1914, with a total connected load of 152.25 kw. The

price of these articles totaled $21,785, and they were handled at a gross profit of $6,958. The estimated addition to income from these appliances in energy billed is $11,230. The year was the best in the history of the appliance division in the Electric Shop.

In the first six months of 1914 the company made 1350 deliveries of appliances by one employee who used

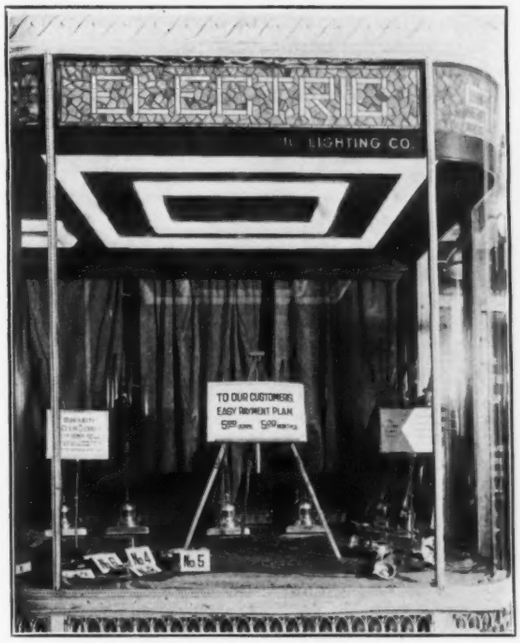


FIG. 3—IN THE VACUUM-CLEANER CAMPAIGN THE WINDOW PROVED ITSELF A VALUABLE SELLING INFLUENCE

a horse and wagon and the local trolley system. This arrangement was unsatisfactory, and the cost per package was from 35 to 50 cents. In addition, it was necessary for this employee to call at customers' homes for appliances to be repaired. By patronizing a local express company this delivery cost was reduced to 10 cents per package within the city limits, except for larger appliances, such as portable lamps, for which 20 cents was charged. Since engaging the package-delivery company the services of the delivery man have been eliminated, and 1468 deliveries were handled at an average cost of 13 cents compared with 26.6 cents previously. The customers also receive better service. Out-of-town deliveries are sent by parcel post or express. The service has been improved by sending repaired appliances directly from the maintenance station to the customer without routing through the Electric Shop.

Selling Campaigns

The story of the year's activity in the Electric Shop is an interesting one, embracing a large number of active selling campaigns. Every effort has been made to conduct this merchandising enterprise in accordance with the best practice of retail store management. The arrangement of the store itself and the display of the goods has been studied to strengthen the appeal. Special compartments have been constructed along the wall in which individual portable lamps are exhibited. Oriental prayer rugs are used for covering the display tables. Frequent changes are made in the arrangement of the store to keep it continuously interesting to all the public. In short, all the devices of the modern merchant have been devoted to featuring electric household appliances in keen competition with all the other diverting influences of the local market.

In commenting, in his annual report, on the specific campaigns of the year, Mr. E. R. Davenport, sales manager of the company, says:

"During the past year we have conducted several campaigns, most of which have proved successful. On Feb. 2 we conducted a campaign on the pot-style percolators, during which we allowed $1 toward the purchase price of an electric percolator to any customer who delivered to the Electric Shop any old peocolator other than one electrically operated. Owing to the fact that we advanced appliance prices to list shortly after the first of the year, the results from this campaign were not so large as we anticipated, but nevertheless we disposed of ten percolators.

Demonstrating Household Devices

"From Feb. 16 to Feb. 28 we exhibited a line of appliances in the food fair at Infantry Hall, but were not very successful in selling many devices. Each day during the show we demonstrated different appliances and, in addition to heating devices, gave a demonstration during the last week of the show of a vacuum cleaner, this demonstration being handled by a demonstrator furnished by the manufacturer of the machine. No sales were made during the demonstration, but we received the names of the many 'prospects' to whom we later sold machines. As far as this particular demonstration was concerned, I believe it was successful in that a very large proportion of the 'prospects' bought cleaners.

"On March 9 a manufacturer of drilling tools mailed 200 invitations to visit the Electric Shop and to witness a window demonstration on electric drills. A man was provided to operate the different sizes of drills in the window, and another man was detailed in the store to supply any information which was desired by interested customers. Our company was not obliged to assume any of the expense of this campaign, and nine

FIG. 4—THIS DISPLAY EXEMPLIFIES THE HIGH STANDARD OF WINDOW TRIMMING MAINTAINED

drills were sold during the week. Since that time we have sold several more.

"During the week of May 11 a campaign was made on a new-type stove which resulted in the sale of 1130 stoves. Although the sale was scheduled to run a week, we commenced our campaign on the first of May and took orders for delivery during a week when special

prices obtained. Prizes to the amount of $80 were awarded to the salespeople, both inside and out, for the largest individual sales of this stove. At one of our monthly meetings estimates were taken of the number of stoves which the individuals believed they could sell. The estimated total was 209, against the actual sales of 1130. The total sales of the Electric Shop alone were 757. In 1913 a sale on the toaster stove was conducted, but resulted in the sale of only 235. In addition to selling 1130 stoves, we realized a profit on other stoves sold to jobbers at our regular discount. This sale, therefore, showed a profit of $776.88, deducting the $80 offered in prizes to the salespeople. As nearly as we are able to ascertain from other sources, our results for the sale—1130 stoves—exceeded those of any other central station in the East.

"During the year it was decided to sell vacuum cleaners in the Electric Shop for the first time since its opening. The machines were sold on easy terms. On April 14 we started a newspaper campaign on cleaners, together with a window demonstration, and the results were sixty-three sales.

"A fan campaign was started on June 1. The total number of fans sold during this campaign was ninety. Owing to the unseasonable weather, the fan campaign was not particularly successful. Prizes amounting to $100 were awarded to the salespeople selling the largest number of fans, each individual receiving a certain number of points and each sale depending upon the possibilities of selling fans in his territory.

Selling Flatirons to Saturation

"On June 22 a campaign was started on flatirons, in charge of a manufacturer's representative. This was continued for about two weeks, at which time the representative informed us that 75 per cent of our customers already had flatirons, and hence it was impossible for him or his men to secure any orders. The results of this campaign were twenty-nine flatirons. Each salesman was allowed 50 cents on each flatiron sold, payable the week after the order was taken, delivered and accepted by the customer. In this way we guarded against other than bona-fide orders and a very small percentage of the orders delivered were returned.

"On July 11 a second flatiron campaign was started in which we used men of our own selection. This resulted in 230 flatirons being sold. In addition fourteen vacuum cleaners, two grills, two toasters and four toaster stoves were disposed of. Our system of paying the salesmen was to allow them a drawing account of 50 cents each day for one week. If their commission did not equal their drawing account, their services were discontinued. During the entire campaign we did not find it necessary to dispense with the services of any of the salesmen, and in the course of this campaign we canvassed our entire territory. Throughout the year the sale of electric flatirons was authorized on the same terms as those on which the local gas company was selling flatirons, nothing down and $1 per month.

"A Christmas campaign, consisting of newspaper advertising, circular letters to all of our customers, billback advertisements, special price reductions, special window displays, bill posters, and the giving of tungsten lamps with all portable lamps sold, was entered upon about Dec. 10. The results are shown in the Electric Shop report.

"The gross sales for this month amounted to $5,383.95, representing the sale of 908 appliances, and as compared with those of 1913 for the same period, show an increase of $510.87.

Window Displays

"The show windows in the Electric Shop have attracted more than the usual amount of attention. During Christmas week these windows were dressed anew every three days, and the company is planning to change all windows every three days throughout the coming year. The accompanying schedule indicates the care which was exercised to diversify the displays, and something of the results clearly traceable to window influence.

Electric-Shop Demonstrations

"On Jan. 31 a popcorn party was held in the Electric Shop, to which the public was invited. Many children participated in the distribution of popcorn made on the grill in the window of the store, and the party proved quite a success. We secured the services of two or three young men to pop the corn and distribute it to the children in the store, and besides a cornucopia of popcorn, each child was handed a little booklet describing the grill. The expense for popcorn, etc., for this party amounted to but $2.50.

"In the week of April 30 demonstrations of vacuum cleaners occupied the windows, and on May 25 a similar demonstration was made on another cleaner, which resulted in seven sales. It is difficult, of course, to check the actual results of a demonstration of this kind, as orders are received for the appliances many weeks after the demonstrations have been closed. The prospective purchaser may be attracted by the window display but not be prepared to buy at that time. He may purchase at a later date. This has been found to be the case many times where customers have called on the telephone or visited the store, asking for an article which was on display in our windows some weeks before. Other demonstrations followed, however, from time to time, such as the making of waffles during an electric-stove exhibit. The waffles were distributed to persons entering the store, and were the means of creating considerable interest in the campaign. A motion-picture show was also held in the Electric Shop during the evenings of April 30, May 1 and 2, and attracted many hundreds of people." In this manner the public eye has had constantly held before it the subject of electricity in the home, and the Electric Shop has established for itself

RESULTS OF WINDOW DISPLAYS

Date		Article	Sales
Jan.	7-13	Portables	14
	14-16	Luminous radiators	14
Feb.	3- 9	Percolators	5
	10-16	Tungsten lamps	956*
March	4- 9	New type aluminum percolator	5
	12-17	Tungsten lamps	890
April	14-20	Vacuum cleaners	6
May	4-11	Stoves	
	11-16	Stoves	702
	25		
June	1	Water heaters	6
	8-15	Flatirons	35
July	15-20	Fans	11
Sept.	10-20	Luminous radiators	9
	26		
Oct.	5	Luminous radiators	11
	14-21	Tungsten lamps	22,093†
	26		
Nov.	2	Portable lamps	24
	10-16	Portable lamps	22
Dec.	3- 7‡	Combination sets of appliances	.....
	10-14‡	Table lamps, desk lamps, piano lamps	.....
	14-17‡	Portable table lamps and boudoir lamps	.....
	17-21§	Appliances, featuring the new aluminum $5 percolator and $3.50 toaster	.....
	21-24§	Chafing dishes and miniature lighting outfits	.....

*Increase over previous week 44.4 per cent. †Edison week ‡During this display the lamps were changed each day. §During this display the entire stock of chafing dishes was offered at a 20 per cent reduction.

a reputation for enterprise and interest that will surely pay increasing dividends.

The Lecture Bureau

In connection with this direct selling activity a widespread indirect influence has been exerted through a regularly organized lecture bureau composed of a number of the company's commercial and engineering staff who have prepared themselves for public lecture work. The bureau had eighteen bookings during the year just closed, and the lecturer addressed an audience averaging seventy-five people on each occasion. These lectures are considered to be a most important part of the company's publicity work and have unquestionably been of much benefit. It has been found that such lectures average no more than $10 in cost.

FIG. 5—A WORKING MODEL OF A TYPICAL FACTORY

The year has been a busy and a profitable one for the Providence central station. In all, 141,792 articles of merchandise were sold by the Electric Shop, the branch offices in Bristol, Arctic, Warren and East Greenwich, and the salesmen throughout the territories. The estimated annual income on this new business figures $225,037.58, with a net expense of only 15 cents per dollar of estimated annual revenue.

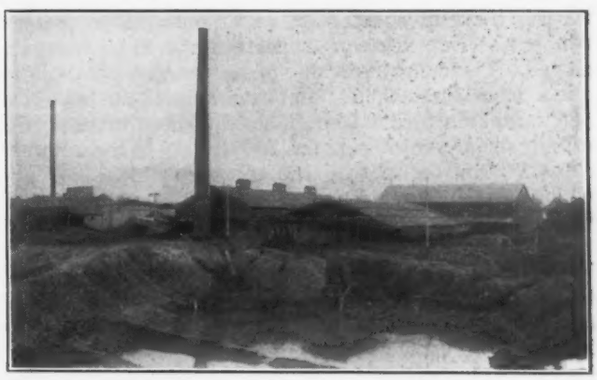
Art-Glass Domes for Window Lighting

A unique and highly ornamental installation of window lighting has recently been installed in one of Chicago's modern jewelry shops, unique in that art-glass domes have been utilized for the illumination of the window display. A single 300-watt round-globe, frosted-tip, gas-filled tungsten lamp was installed in each window under an art-glass dome, suspended about 3 ft. above the "plane of trim," the exact height ranging with the width of the window. This commercial use of art-glass fixtures of a type familiar only in dining-room lighting creates a very distinctive and pleasing effect.

Electricity Saves 10 Cents per 1000 Bricks

Before the Standard Brick Company of Milwaukee, Wis., discarded its steam-engine drive for electric motors taking energy from the lines of the Milwaukee Electric Railway & Light Company the power cost incurred in making its bricks was 38.7 cents per 1000. Since the adoption of central-station service, however, the power cost per 1000 bricks has been reduced to 28.6 cents. Not only has the cost been reduced, but the output has been enormously increased, for with the old prime movers the annual output was only 19,600,000 bricks and now the plant is turning out 120,000 bricks a day.

In the old installation the disintegrator, plug mill, brick machine, dry pan, conveyors and hoists were all driven by a 250-hp non-condensing Corliss engine, and four small slide-valve steam engines were driving blowers ranging in size from 5 ft. to 10 ft. Steam was supplied by three 100-hp return-tubular boilers. Tests conducted by the new-business department of the central-station company under the direction of Mr. R. B. Snyder showed that while the gross indicated load on the large Corliss engine was 161.8 hp, the power consumed in shafting and engine friction was 55.6 hp.



BRICK FACTORY IN WHICH ELECTRICITY EFFECTED SAVING AND INCREASED OUTPUT

When these steam engines were removed one 200-hp variable-speed motor was installed to replace the Corliss engine and three 10-hp slip-ring motors replaced the engines driving the blowers. Tests made since the electrical drive has been placed in operation show that it requires 15.5 kw-hr. to make 1000 bricks. Coke fires are used to heat the air blasts used for drying the brick, as the fires have been found to heat the air more economically than steam coils.

"Made in Youngstown" Window Displays Prove Popular

Everything from leather halfsoles to boxes of chocolate candy has in its turn been exhibited in the show windows of the Youngstown (Ohio) Consolidated Gas & Electric Company during the last year. The central-station company gave each of its motor-service customers, regardless of his connected load, the privilege of using the company's large display windows for one week. The displays have attracted much attention, and Mr. C. E. Yacoll, of the company's commercial department, says that the exhibits have awakened Youngstown's people to a realization of the wide variety of products made in Youngstown with central-station power. Local motor-service users have shown themselves much pleased at the company's co-operation with its customers. Some of the manufacturers, after using the window, were able to trace orders to the advertising received from the central-station displays.

Operating Cost of Commercial Electric Vehicles

Results of the Investigation Undertaken by the "Electrical World" to Produce Authenticated Data Based on Testimony of Users

By William P. Kennedy*

In the issues of the Electrical World dated Oct. 3, 10 and 17, 1914, announcement was made of an undertaking to determine the cost at which electric vehicles are being operated in the large installations throughout the country, upon the testimony of the owners of these equipments. This work has so far progressed that there has been accumulated sufficiently conclusive evidence upon which to base the cost of electric-vehicle service.

As previously stated, a selection was made of 150 of the most representative installations, including nearly all the lines of mercantile and industrial activity in which electric-vehicle transportation equipment is employed. The collective value of these equipments aggregates over $10,000,000, and the annual operating expense exceeds $7,800,000. They include 3090 machines of all sizes, ranging from 700 lb. to 5 tons haulage capacity, and constitute the most reliable basis upon which the information sought could possibly be developed.

On account of the diversity of interests concerned, but particularly by reason of the necessity of waiting the convenience of those members of each organization who alone were in a position to supply the required information concerning the cost of operation, much time has been consumed in completing the compilation.

In many instances it was difficult to evoke any interest at all, notwithstanding the fact that the work of preparing the documents which constituted an abstract statement of the investment and operating expense of their equipments was done in advance of any request for the co-operation of the vehicle owners in comparing these with their records for verification.

A few of the owners of vehicles frankly acknowledged that they kept no records and therefore could supply no information. Another small number advised that the policy of their organizations prohibited them from giving out any data whatever concerning their operations. The majority of the correspondents, however, freely entered into the consideration of their cases, taking up the peculiarity of their operating conditions and the reasons, if any, why their records varied from the figures we submitted to them. Many supplied copies of their records as they existed upon their own books.

Actual verifications in writing over the signature of the owner or operator cover 50 per cent of the cases investigated. Of the remainder, the large majority have either promised to send written verification or have acknowledged their concurrence with the figures submitted, but for various reasons are not at liberty to verify the figures in writing, while personally giving expressions of agreement.

It seems quite evident, as the cost of operation in all the installations covered is so nearly uniform, that the verifications received up to date practically confirm the whole collection of data. Additional verifications will simply increase the volume of testimony without materially altering the quality.

In the table herewith are outlined the essential features of each installation covered. The boldface type signifies those owners from whom we have received communications in writing testifying that the statements submitted by us are practically in agreement with their records and experience. The names in small capitals indicate the cases in which the verification has been either promised or assented to; from many of these we cannot hope to secure testimony in writing on account of the policy of the companies or some such reason. Those having a double asterisk before their names possess no records that can be made available for the desired purposes. For the names in ordinary type the figures are as yet indefinite. At the end of the list are shown some records of companies that have stated

ELECTRICAL WORLD — Schedule A

Cost Analysis—Electric Vehicle Installation

Of _____

Business _____ 19__

INVESTMENT				
1- 2000#	Machines	@ $ 2800		$ 2800.00
4- 4000#	"	@ 3400		13600.00
5- 7000#	"	@ 4000		20000.00
15-10000#	"	@ 4500		67500.00
		@		
Spare Parts Equipment				2597.50
Garage Equipment				2500.00
Office Equipment				250.00
Buildings				
	TOTAL INVESTMENT			109247.50
ANNUAL OPERATING EXPENSES				
FIXED CHARGES				
Interest on Investment	$ 109247.	@ 3 %	$ 3277.42	
Depreciation:				
Machine Equipment	$ 103900.	@ 10 %	10390.00	
Spare Parts Equipment	$ 2597.	@ 10 %	259.75	
Garage Equipment	$ 2500.	@ 5 %	125.00	
Office Equipment	$ 250.	@ 5 %	12.50	
Buildings	$	@	%	
Insurance Liability-Fire		@	%	5539.00
Licenses	25	@ $7		175.00
		TOTAL FIXED CHARGES		$ 17778.67
MAINTENANCE				
Tire Upkeep (Labor and Material)			$ 11761.00	
Battery Upkeep (Labor and Material)			9390.00	
Mechanical Upkeep (Labor and Material)			5195.00	
		TOTAL MAINTENANCE		$ 26346.00
GARAGING				
Electric Power	@	cts. per K. W. H.	$ 9170.00	
Supplies, Lubricants, Washing Materials, etc.			1155.00	
Labor, for cleaning and care			1540.00	
Rent, Light, Heat, Water and Telephone			2737.50	
Building Upkeep				
		TOTAL GARAGING		$ 14602.50
OPERATION				
25	Drivers @ $18 (Average)	x 52 weeks $23400		
	Helpers @	" x 52 "	$ 23400.00	
Demurrage, Ferry Charges, Claims, Damage, Accidents				
Extra Horse and Wagon Hire, Expressage, etc.				
Platform Labor				
Miscellaneous Expense				
		TOTAL OPERATION COST		23400.00
ADMINISTRATION or Supervision				
Salaries and Office Expense				$ 2500.00
				$
		TOTAL ANNUAL EXPENSES		54627.17

FIG. 1—FAC-SIMILE OF SCHEDULE A, SENT TO VEHICLE USERS FOR CONFIRMATION

that it might be detrimental to their business interests to publish their costs as they are engaged mainly in the transportation field.

Methods Employed

Inasmuch as the ultimate purpose of the Electrical World was to compile cost data upon a uniform basis from all the installations covered, it was necessary to

*Consulting transportation engineer.

devise blanks that would provide a comprehensive means of reducing to standard terms all the various forms of record keeping employed in the accounting departments of the many companies involved. With this object in view, it was also necessary to eliminate as far as possible unessential variations which might conflict with the application or utility, as comparative data, of the cost figures obtained. Hence the investment represented by each machine was taken at the market value instead of the price actually paid for it, which might be influenced by discount for quantity purchased at the time it was ordered. Likewise, the quantity discount consideration was omitted in the cost of tire and battery upkeep material, as this is incidental only to quantity installations and not of immediate interest to the

ELECTRICAL WORLD — SCHEDULE B

Statement of Proportionate Machine Operating Expense

(ANNUAL)

CAPACITY OF MACHINE	2000#	4000#	7000#	10000#		Annual Totals
Annual Charges per Machine						
Interest @ 3 %	84.00	102.00	120.00	135.00		
Depreciation @ 10 %	280.00	340.00	400.00	450.00		
Insurance	129.00	134.00	140.00	145.00		
License	7.00	7.00	7.00	7.00		
Tire Upkeep	412.00	306.00	340.00	575.00		
Battery Upkeep	300.00	288.00	345.00	415.00		
Mechanical Upkeep	140.00	170.00	200.00	225.00		
Electric Power	170.00	300.00	340.00	400.00		
Total per Machine	1221.00	1644.00	1932.00	2352.00		
Number of Machines	1	4	5	15		
Total per Group	1221.00	6576.00	9660.00	35280.00		52737.00
Proportionate General Charges					Other Equipment	
Interest on Additional Investment @ 3 %	6.42	25.68	32.10	96.30		160.42
Depreciation on Additional Equipment @ %	15.83	63.56	79.45	238.35		397.25
Garaging less power	217.30	869.20	1086.50	3259.50		5432.50
Administration	100.00	400.00	500.00	1500.00		2500.00
Annual Expense per Group, less Operator	1560.61	7934.44	11358.05	40374.15		61227.17
Expense per Machine per Annum	1560.61	1983.61	2271.61	2691.51		
Expense per Machine per Day	5.07	6.44	7.38	8.74		
Operators per Day	2.50	2.50	3.00	3.00		23400.00
Other Operation Exp						
Total per Machine per Day	7.57	8.94	10.38	11.74		84627.17
Cost per Ton						
Cost per Package						
Cost per Mile						

FIG. 2—FAC-SIMILE OF SCHEDULE B, SHOWING ANALYSIS OF COSTS

average prospective user for whom this whole information is primarily intended.

For similar obvious reasons the cost of electrical energy for battery charging was taken at a uniform rate of 4 cents per kw-hr., and the operator's wages at $2, $2.50 and $3 per day, for small, medium and heavy machines respectively, only one operator being charged in each case. The values selected being the prevailing prices and practices, it will be apparent that the discounts mentioned above and the possibly lower cost of energy in large installations will make it practicable to operate at lower figures than those determined as the daily cost. In other words, the figures which have been determined by this project as the prevailing daily cost for a machine of each size are those at or below which electric vehicles may be operated. They are the "bogey," so to speak, which the ordinary performer can accomplish. Those skilled in the art of the care and application of machines may do better. Hence a number of correspondents have stated that their actual expense was from 5 to 10 per cent below the values stated. Some few have estimated their costs lower by 15 per cent or more, but in each of the latter cases some good reason was given for the lower cost, such as no charge having been made for energy, rent, or some other cost factor equivalent to the difference.

The blanks used to secure the information desired in each case are shown in Figs. 1 and 2.

Schedule A (Fig. 1) shows the investment and annual operating expense of the total equipment. In Schedule B against each size of machine in the installation are shown the charges appearing in the annual operating expense statement, so that at the bottom of Schedule B is determined the daily operating cost of a machine of each size, with and without the driver.

In the investment account is included not only the value of the vehicles, but also that of the equipment necessary to their employment, such as spare parts, charging apparatus and other garage devices, as well as office equipment, books and record-keeping necessities. The investment in buildings was omitted, as were also the charges for their depreciation and upkeep, as the item of "rent" in the garaging expenses will adequately take care of the charges against buildings in every case, whether these are owned or leased.

The annual operating expense covers all the charges which can be made against the equipment upon an annual basis under the five subdivisions of fixed charges, maintenance, garaging, operation, and administration.

The fixed charges include the interest and the depreciation at generally accepted rates. While the interest is shown at 3 per cent on the original investment, this is intended as the equivalent of 6 per cent on the average investment spread over the life of the equipment. In explanation of this statement it may be said that the original or total investment is gradually refunded by the charges made for depreciation. Hence the amount of money represented in the investment is constantly being reduced. The average investment per annum throughout the life of the equipment will therefore be equivalent to half the original investment. Instead of stating the interest as 6 per cent on one-half the investment, use has been made of the method generally preferred by auditors, of stating the equivalent in interest at 3 per cent on the total investment.

In view of the fact that when their equipments were first secured many owners arbitrarily decided upon a five-year life and charged their depreciation accordingly at 20 per cent per annum, while those owners who have actually used their equipments for ten years find them still in as serviceable condition as ever, with prospective life ahead of another ten years, and hence estimate the rate of depreciation at 5 per cent per annum, the charge for depreciation has been set herein at 10 per cent per annum, which may be regarded as a reasonable compromise.

In "fixed charges" are included insurance and licenses, in order that maintenance (or the upkeep of the equipment in working condition) and garaging may be separated, for the reason that maintenance and garaging are often separately contracted for outside of the organization of the owner. Under "insurance" there has been made in most cases a limited charge of $100 per car for liability and 1 per cent of its value for insurance against loss by fire in order to unify the charge for insurance, which is subject to considerable variation in different parts of the country, being usually highest in the large cities. This limitation of insurance charges and also the charge of 4 cents per kw-hr. for energy, as well as the scale of drivers' wages cited above, should be borne in mind in interpreting the final daily cost figures.

The mechanical upkeep is intended to include every charge relating to the maintenance in serviceable con-

DATA ON OPERATING COSTS OF ELECTRIC VEHICLES

Boldface type signifies firms which have confirmed in writing the figures stated; SMALL CAPITALS, those for which figures are assented to or promised; two asterisks (**), those for which no records are available. In other cases the figures are indefinite.

Name	Business	Investment in Equipment	Annual Operating Expense	Number of Machines	Operating Cost per Day — Capacity in Tons								
					½	½	¾	1	1½	2	3	3½	5
Abraham & Straus, Brooklyn	Department store	$67,200	$53,783	22	....	....	....	$7.78	....	....	....	$11 01	....
Acker, Merrall & Condit, New York	Groceries	25,055	19,203	6	....	....	....	....	....	....	$10.25	10.37	....
Adams Express Company, New York	Express	151,250	116,408	52	....	$6.54	....	8.02	....	....	....	....	....
Adams Express Company, Buffalo	Express	54,050	42,639	18	....	6.35	....	7.55	$8.08	....	....	....	....
Adams Express Company, Philadelphia	Express	584,400	396,998	146	....	....	$7.63	7.93	8.13	$9.65	....	....	....
Adams Express Company, Indianapolis	Express	39,545	30,372	11	....	....	....	....	....	8.93	....	....	....
Æolian Company, New York	Musical instruments	38,687	29,234	10	....	....	6.94	....	8.02	8.93	....	10.37	$11.39
B. Altman & Company, New York	Department store	49,665	41,165	21	....	6.34	....	....	....	....	....	....	....
American Brewing Company	Brewers	57,035	37,060	12	....	6.35	....	7.56	....	8.93	10.25	10.37	11.73
American Gas Company, Philadelphia	Gas supply	22,610	18,249	8	....	6.34	....	7.55	....	....	....	....	....
Anheuser-Busch Company, St. Louis	Brewers	206,912	158,723	50	....	....	....	....	8.09	....	....	10.37	11.74
ARNOLD-CONSTABLE COMPANY, NEW YORK	Dry goods	36,895	29,381	13	....	6.34	....	7.55	....	8.92	....	10.36	....
Ayers & Company, Indianapolis	Department store	16,145	13,783	7	....	6.33	....	7.32	....	....	....	....	....
Baltimore Bargain House, Baltimore	Dry goods	78,130	60,133	17	....	....	....	....	....	8.94	....	10.37	11.74
Best & Company, New York	Clothing	18,920	15,682	8	....	6.87	....	....	....	....	....	....	....
BERGDOLL BREWING COMPANY, PHILADELPHIA	Brewers	65,617	49,874	16	....	....	....	7.57	....	8.94	....	10.37	11.74
**Berghoff Brewing Company, Fort Wayne, Ind	Brewers	20,332	15,877	5	....	....	....	....	....	8.94	....	10.37	11.74
Bernheimer & Schwartz Brewing Company, New York	Brewers	47,225	36,287	10	....	....	....	....	....	....	....	....	12.00
Birmingham Ry., Lt. & Pr. Company, Birmingham, Ala.	Energy supply	10,997	8,796	4	....	6.34	6.87	....	....	8.88	....	....	....
WM. H. BLOCK & COMPANY, INDIANAPOLIS	Department store	28,475	22,647	11	....	6.34	....	7.55	....	8.92	....	....	....
Bonwit, Teller & Company, New York	Clothing	9,625	8,455	4	$6.43	6.96	....	....	....	....	....	....	....
S. S. Brown & Company, New York	Groceries	18,290	14,606	6	....	....	....	7.55	8.03	....	....	....	....
Blank Dry Goods & Furniture Company, New York	Department store	11,305	9,124	4	....	6.90	....	7.80	....	....	....	....	....
Campbell Bread Company, Wichita, Kan	Bakers	13,825	10,256	5	....	6.63	....	....	....	....	....	....	....
**Capwell Company, Oakland, Cal	Department store	16,590	12,307	6	....	6.63	....	....	....	....	....	....	....
Carson, Pirie, Scott & Co., Chicago	Department store	148,505	106,945	46	....	6.68	....	7.92	9.23	....	10.39	11.51	....
CASE & MARTIN, CHICAGO	Bakers	82,900	58,115	23	5.68	6.34	....	8.00	8.31	....	10.24	....	....
Central Brewing Company, New York	Brewers	217,975	167,682	48	....	6.36	....	....	7.57	8.94	10.25	10.44	11.74
CHAPIN SACKS MANUFACTURING COMPANY, WASHINGTON	Confectioners	39,355	30,015	13	....	....	....	7.55	....	8.93	....	....	....
**H. B. Claflin & Company, New York	Dry goods	51,690	38,632	13	....	....	....	8.04	....	....	9.75	....	....
Clausen-Flanagan Brewing Company, New York	Brewers	35,857	26,113	7	....	....	....	....	....	....	....	....	12.00
Connecticut Breweries Company, Bridgeport	Brewers	14,175	11,608	4	5 70	....	....	....	....	8.93	....	10.37	11.73
Consolidated Gas Company, New York	Gas supply	97,354	77,932	37	5 52	....	....	7.13	....	7.74	....	....	....
Consolidated Gas, Electric Light & Power Co., Baltimore	Gas and energy supply	107,682	86,525	35	5.69	6.34	....	7.55	....	8.93	....	10.36	11.73
COMMERCIAL TRUCK & MAIL SERVICE CO., ST. LOUIS	Transportation	22,200	18,460	8	....	....	....	7.46	....	....	....	....	....
COMMONWEALTH EDISON COMPANY, CHICAGO	Energy supply	429,265	311,478	120	5.69	6.35	$7.05	7.05	9.23	8.92	....	10.36	11.72
Crowley-Milner Company, Detroit	Department store	32,185	24,947	10	....	6.59	....	7.92	....	9.51	....	....	....
Cushman Globe Company, New York	Bakers	13,018	12,814	7	5.65	6.15	....	7.54	....	....	....	....	....
S. Cushman's Son, Inc., New York	Bakers	23,767	22,549	12	5.68	6.33	....	7.54	....	8.92	....	....	....
CURTIS PUBLISHING COMPANY, PHILADELPHIA	Publishers	47,247	35,186	11	....	6.65	....	8.04	....	....	....	10.37	11.74
Detroit Evening News, Detroit	Publishers	38,540	29,150	11	....	6.60	....	7.92	....	9.51	....	....	....
Denver Gas & Electric Company, Denver	Energy supply	59,362	50,935	22	5.68	6.30	7.66	7.55	8.31	9.21	....	10 36	....
Duquesne Light Company, Pittsburgh	Energy supply	9,665	8,087	4	....	6.28	6.80	....	....	....	....	....	....
The Delivery Company, Cleveland	Transportation	67,612	52,133	25	....	6.45	....	7.72	....	8.98	....	10.46	....
Peter Doelger Brewing Company, New York	Brewers	225,015	195,951	54	....	....	....	....	....	....	....	....	11.74
Jacob Dold Packing Company, Buffalo	Packers	11,400	8,807	3	....	....	....	....	....	8.93	....	10.37	....
Ebling Brewing Company, New York	Brewers	59,635	41,587	11	....	....	....	....	....	....	....	11.39	12.32
Edison Electric Illuminating Company, Brooklyn	Energy supply	14,940	8,699	4	....	....	....	....	6.77	6.83	....	....	10.22
Edison Electric Illuminating Company, Detroit	Energy supply	76,067	55,425	24	5.68	6.64	6.82	....	8.31	8.92	....	10.36	11.72
**Electric Dispatch Company, Los Angeles	Transportation	73,722	56,981	17	....	....	....	....	....	8.94	....	10.50	11.74
Henry Elias Brewing Company, New York	Brewers	27,812	19,211	5	....	....	....	....	....	....	....	....	12.32
John Eichler Brewing Company, New York	Brewers	27,812	19,211	5	....	....	....	....	....	....	....	....	12.32
A. Erdrich & Son, Frankford, Pa	Brewers	36,755	28,186	8	....	....	....	....	....	....	....	10.37	11.74
Excelsior Brewing Company, Brooklyn	Brewers	43,902	33,014	9	....	....	....	....	....	....	....	....	12.32
The Fair, Chicago	Department store	80,710	70,571	33	....	6 10	....	7.19	8.40	9.50	....	....	....
**Chr. Fiegenspan, Inc., Newark	Brewers	23,100	17,722	5	....	....	....	....	....	....	....	10.38	11.74
Marshall Field & Company, Chicago	Department store	502,310	406,104	192	....	6.17	....	....	8.13	9.18	....	10.14	....
Theo. Finkenauer Brewing Company, Philadelphia	Brewers	31,835	21,297	8	....	....	....	6.16	....	7.72	....	8.96	....
FLEISHMANN CO., NEW YORK	Bakers	49,842	54,685	31	5.61	....	....	....	....	8.85	....	....	....
Robert Gair, Brooklyn	Paper goods	49,985	37,399	12	....	....	....	7.82	....	9.51	....	10.37	11.74
Gardiner Dairy Company, Baltimore	Dairy products	20,050	16,035	5	....	....	....	....	....	....	....	12.73	....
GENERAL BAKING COMPANY, NEW YORK	Bakers	37,960	27,151	12	....	....	....	7.75	....	....	....	....	....
GENERAL BAKING COMPANY, BUFFALO	Bakers	15,215	11,911	5	....	6.34	....	7.55	....	8.92	....	....	....
GIMBEL BROS., NEW YORK	Department store	219,305	182,226	83	....	6.16	....	7.50	8.12	....	....	10.60	....
Goldenberg Brothers Company, New York	Dry goods	9,660	7,904	4	....	6.34	....	....	....	....	....	....	....
Gorham Manufacturing Company, New York	Silversmiths	38,550	30,913	15	....	6.34	....	7.55	....	8.92	....	....	....
J. B. Greenhut Company, New York	Department store	58,790	42,707	17	....	6.49	....	7.69	....	....	....	10.50	....
Haffenreffer Company, Boston	Brewers	23,612	18,143	5	....	....	....	....	....	....	....	....	10.64
Hammacher-Schlemmer Company, New York	Hardware	24,395	18,410	6	....	....	....	7.29	....	10.15	10.56	10.70	....
Hartford Electric Light Company, Hartford	Energy supply	44,596	33,441	15	5.83	6.63	....	8.02	....	9.78	....	....	....
A. B. Hastings & Sons, Campello, Mass	Bakers	18,390	12,559	6	....	6.10	....	....	....	....	....	....	....
Jas. A. Hearn & Son, New York	Department store	99,300	72,394	34	....	6.63	....	....	....	....	....	11.19	....
H. J. HEINZ COMPANY, NEW YORK	Food products	25,220	16,536	5	....	....	....	....	....	10.05	....	11.14	....
**Theo. R. Helb, York, Pa	Brewers	22,910	18,352	7	....	6.35	....	7.56	....	8.92	....	10.40	....
Horn & Hardart Baking Company, Philadelphia	Bakers	35,135	25,633	11	....	6.64	....	8.03	....	8.92	....	....	....
**Jacob Hoffman Brewing Company, New York	Brewers	37,780	29,029	8	....	....	....	....	....	....	....	....	11.74
Fred Hollender & Company, New York	Brewers	13,215	9,644	3	....	....	....	....	....	8.93	....	10.37	....
Houghton & Dutton Company, Boston	Department store	14,285	11,461	5	....	6.34	....	7.55	....	....	....	....	....
Otto Huber Brewing Company, Brooklyn	Brewers	23,100	17,722	5	....	....	....	....	....	....	....	10.38	11.74
Kips Bay Brewing Company, New York	Brewers	23,100	17,722	5	....	....	....	....	....	....	....	10.38	11.74
A. LEISNER & COMPANY, WASHINGTON	Department store	30,340	22,922	10	....	6.27	....	7.89	....	9.51	....	....	....
Lembeck & Bets Brewing Company, Jersey City	Brewers	23,612	18,143	5	....	....	....	....	....	....	....	....	11.74
Lincoln Safe Deposit Company, New York	Storage	31,220	24,227	8	....	....	....	7.55	....	....	....	10.37	....
Henry Lindenmeyr & Sons, New York	Paper goods	14,250	10,488	4	....	....	....	8.08	....	8.98	....	....	....
V. Loewer's Brewing Company, New York	Brewers	58,112	44,772	13	....	....	....	7.57	....	....	....	10.38	11.74

DATA ON OPERATING COSTS OF ELECTRIC VEHICLES (Continued)

Boldface type signifies firms which have confirmed in writing the figures stated; SMALL CAPITALS, those for which figures are assented to or promised; two asterisks (**), those for which no records are available. In other cases the figures are indefinite.

Name	Business	Investment in Equipment	Annual Operating Expense	Number of Machines	Operating Cost per Day — Capacity in Tons								
					⅛	½	¾	1	1½	2	3	3½	5
Louisville Gas & Electric Company, Louisville	Energy supply	$18,320	$18,183	10	$5.62	$6.27	....	....	....	....	.....	.....	.....
R. H. Macy & Company, New York	Department store	111,160	79,002	35	....	....	....	$7.44	....	$8.95	.....	.....	.....
HENRY MAILLARD, NEW YORK	Confectioners	14,220	11,203	5	....	6.34	....	8.03	....	8.92	.....	.....	.....
Manila Electric Light Company, Manila, P. I.	Energy supply	84,370	59,701	21	5.86	6.54	....	8.04	$8.31	9.79	.....	$11.38	$12.88
Mandel Brothers, Chicago	Department store	113,780	78,347	37	....	6.77	$7.41	....	8.32	....	.....	.....	.....
Manhattan Brewing Company, Chicago	Brewers	40,760	31,522	9	....	....	....	7.57	....	....	.....	.....	11.74
**James McCreery & Company, New York	Dry goods	9,555	7,433	3	....	....	....	7.55	....	8.97	.....	.....	.....
John Meyer, Brooklyn	Baker	17,815	14,149	5	....	6.34	....	7.55	....	8.92	.....	.....	.....
Milwaukee Electric Railway & Light Co., Milwaukee	Energy supply	41,412	35,166	14	5.69	6.34	....	7.55	....	8.93	.....	10.36	.....
Geo. Muehlbach Brewing Company, Kansas City	Brewers	58,530	45,156	14	....	....	....	7.57	....	....	.....	10.38	11.74
National Ice Company, Portland, Ore.	Ice	15,580	11,672	4	....	....	....	....	....	9.44	.....	.....	.....
New Orleans Railway & Light Company, New Orleans	Energy supply	38,117	30,629	12	5.69	6.35	....	....	....	8.93	.....	10.36	.....
N. Y. Edison Company, New York	Energy supply	310,295	256,225	107	5.68	6.34	....	7.55	8.07	8.92	$10.23	10.35	11.72
New York Transfer Company, New York	Transportation	42,100	32,068	10	....	....	....	....	....	....	.....	10.36	.....
N. Y. & Queens Elec. Lt. & Power Co., Long Island City	Energy supply	74,768	36,766	19	6.52	7.04	....	7.19	....	8.03	.....	.....	.....
PACIFIC GAS & ELECTRIC COMPANY, SAN FRANCISCO	Energy supply	45,527	37,861	16	5.69	6.34	....	7.56	....	8.92	.....	10.36	.....
Pacific States Electric Company, Los Angeles	Energy supply	16,745	12,955	5	....	....	....	7.56	....	8.93	.....	.....	.....
PIERCY CONTRACTING COMPANY, NEW YORK	Transportation	92,850	78,954	39	5.91	6.34	7.46	7.55	8.06	....	.....	.....	11.72
Philadelphia Electric Company, Philadelphia	Energy supply	117,279	98,621	41	7.32	7.64	....	9.64	....	5.67	10.36	.....	11.89
**Pittsburgh Plate Glass Company, New York	Glass	14,995	11,334	4	....	....	....	....	....	8.93	.....	10.37	.....
F. A. Poth & Son, Philadelphia	Brewers	143,550	111,690	34	....	....	....	7.57	....	8.94	9.75	10.37	11.74
Puget Sound Traction, Light & Power Company, Seattle	Energy supply	11,124	7,454	3	....	6.88	....	....	....	7.21	.....	10.12	.....
James Pyle & Son, Edgewater, N. J.	Soaps	17,250	13,381	4	....	....	....	....	....	8.94	.....	10.37	11.74
ROCHESTER RAILWAY & LIGHT COMPANY, ROCHESTER	Energy supply	117,912	99,258	46	5.68	6.34	....	7.55	8.07	8.92	.....	10.36	11.72
**Rochester Carting Company, Rochester	Transportation	35,012	26,883	8	....	....	....	....	....	....	10.25	10.38	11.74
Jacob Ruppert, Inc., New York	Brewers	531,000	375,264	103	....	....	....	8.34	....	9.24	.....	10.42	12.17
Sibley, Lindsey & Curr, Rochester	Department store	16,950	13,249	5	....	....	....	7.56	....	8.93	.....	10 49	.....
Adam Scheidt Brewing Company, Norristown, Pa.	Brewers	32,655	25,623	8	....	....	....	7.57	....	8.94	.....	10.37	11.74
Schenectady Illuminating Company, Schenectady	Energy supply	16,335	12,659	6	....	6.31	....	7.84	....	8.87	.....	.....	.....
C. Schmidt Brewing Company, Philadelphia	Brewers	109,247	54,627	25	....	....	....	7.57	....	8.94	.....	10.38	11.74
SCHOENHOFEN BREWING COMPANY, CHICAGO	Brewers	52,570	40,171	12	....	....	....	....	....	....	.....	10.37	11.74
**W. & J. Sloane, New York	Carpets	16,840	12,828	4	....	....	....	....	....	....	.....	10.37	.....
Stamford Gas & Electric Company, Stamford, Conn	Energy supply	13,567	11,531	5	5.69	6.34	.....	7.55	....	....	.....	10.36	.....
David Stevenson Brewing Company, New York	Brewers	30,612	19,923	5	....	....	....	....	....	....	.....	.....	12.90
SIMPSON-CRAWFORD COMPANY, NEW YORK	Department store	53,435	42,684	18	....	6.35	....	7.55	7.67	....	.....	.....	.....
**Silk Finishing Company of America, New York	Silk finishers	21,525	16,090	6	....	....	6.98	....	8.04	8.93	.....	.....	.....
Sioux City Brewing Company, Sioux City	Brewers	15,425	11,861	5	....	....	....	6.05	....	7.17	.....	8.30	.....
**Stern Brothers New York	Department store	57,130	45,397	22	....	6.34	....	....	....	8.92	.....	.....	.....
**Stroh Brewing Company, Detroit	Brewers	33,475	25,920	8	....	....	....	....	....	8.95	.....	10.38	11.74
Geo. F. Stuhmer Company, Brooklyn	Bakers	8,325	6,788	3	....	....	.634	7.55	....	....	.....	.....	.....
Taggart Baking Company, Indianapolis	Bakers	15,990	12,223	6	....	6.59	....	....	....	....	.....	.....	.....
J. R. Thompson Company, Chicago	Restaurateurs	32,780	25,698	11	....	....	....	7.55	....	....	.....	.....	.....
Union Electric Light & Power Company, St. Louis	Energy supply	44,612	36,897	17	5.68	6.34	7.35	7.55	....	8.43	.....	.....	.....
United Electric Light & Power Company, New York	Energy supply	91,518	60,015	27	5.14	5.98	....	6.72	....	8.04	.....	9.05	9.98
UNITED GAS IMPROVEMENT COMPANY, PHILADELPHIA	Gas supply	47,775	37,237	15	....	6.35	....	7.56	....	8.92	.....	10.36	.....
U. S. Government Printing Office, Washington	Printing	30,397	22,037	9	....	6.41	....	7.62	....	9.03	.....	10.50	.....
**U. S. War Department, Manila, P. I.	Commissary service	84,390	57,686	19	....	6.65	....	8.04	....	9.80	.....	11.38	.....
A. A. VANTINE, NEW YORK	Oriental furnishings	19,080	14,605	6	....	....	....	7.87	....	....	.....	.....	.....
W. W. Walker Company, Hartford, Conn.	Grocers	27,627	20,545	10	5.84	6.63	....	8.03	....	....	.....	.....	.....
Ward Brothers Company, Rochester	Bakers	59,957	53,703	27	....	6.15	....	....	....	9.73	.....	.....	11.71
Ward Baking Company, Bronx, N. Y.	Bakers	312,992	269,676	145	....	5.57	....	7.07	....	....	.....	.....	.....
Ward Baking Company, Brooklyn, N. Y.	Bakers	316,862	274,441	155	....	5.63	6.02	....	....	....	.....	.....	.....
Washington Water Power Company, Spokane	Energy supply	11,473	7,933	4	6.91	6.19	....	7.57	....	9.67	.....	.....	.....
Geo. Wiedman Brewing Co., Newport, Ky.	Brewers	32,545	24,979	7	....	....	....	....	....	....	.....	10.38	11.74
Willow Brook Dairy Company, Mt. Vernon, N. Y	Dairy products	10,170	7,723	3	....	....	....	7.56	....	....	.....	10.37	.....
Wilmington Steamboat Company, Wilmington Del.	Transportation	19,768	14,018	5	....	....	....	....	....	9.07	.....	.....	.....
Wise, Smith & Company, Hartford, Conn.	Department store	11,032	8,213	4	5.83	6.63	....	8.02	....	....	.....	.....	.....
Woodward & Lothrop, Washington	Department store	41,435	33,969	17	....	6.34	....	....	....	8.92	.....	.....	.....
Worcester Electric Light Company Worcester	Energy supply	21,234	15,299	7	5.44	5.92	....	7.14	....	7.89	.....	8.77	.....
**Yale Brewing Company, New Haven, Conn	Brewers	19,717	15,587	5	....	....	....	....	....	8.93	.....	10.37	11.74
A company	Transportation	490,990	366,473	132	....	6.21	....	7.48	....	8.96	9.66	10.29	.....
B company	Transportation	93,975	71,321	25	....	....	....	....	....	8.93	.....	10.37	11.74
C company	Transportation	98,295	75,130	27	....	....	....	....	....	8.93	.....	10.37	.....
D company	Transportation	57,035	37,060	12	....	6.35	....	7.56	....	8.93	10.25	10.37	11.75
E company	Transportation	17,255	12,846	5	....	6.63	....	8.03	....	....	.....	.....	11.43

dition of all of the physical equipment of the machine except the batteries and the tires.

All of the charges under garaging and operation are self-evident, and therefore require little explanation. Under "operation" are included a number of items incidental to transportation service in many but not all cases.

Under "administration" is prorated against the electric-vehicle equipment a reasonable proportion of the general executive supervision of the organization as well as the accounting and office expense.

On Schedule B are set forth the annual charges against each machine, depending upon its relative size and haulage capacity. The total for each machine has been multiplied by the number of machines of each size in the installation. To the group figures resulting has been prorated a proportionate share of the remaining charges deduced from the statement of annual operating expense, such as administration, garaging, etc. The totals for each group have then been divided by the number of machines of each size to determine the annual cost of each vehicle, without operators. When this cost is divided by the number of working days in the year (308 being taken in all the statements) there is obtained the cost per machine per day, to which the cost of driver and helpers may be added. As explained above, the cost per vehicle per day includes that of only one operator at $2 per day for 700-lb. to 1000-lb. ma-

chines, $2.50 per day for 2000-lb. to 4000-lb. machines, and $3 per day for 6000-lb. to 10,000-lb. machines.

Summary of Results

Electric vehicles are now being operated for the following daily cost, with a possible reduction of from 5 per cent to 10 per cent in large installations or in service where only a limited amount of the machine's daily normal working capacity can be taken advantage of:

Haulage Weight, Lb.	Cost per Day to Operate	Haulage Weight, Lb.	Cost per Day to Operate
700	$5.68	4,000	$8.92
1,000	6.34	7,000	10.38
2,000	7.56	10,000	11.74

In the above table are shown the costs of operating the regular standard sizes in which electric vehicles are made, in so far as mechanical and motor equipments are concerned. Each size may be modified or augmented by change in the battery and the tire equipment.

Lessons from This Investigation

An interesting fact demonstrated by the successful conduct of this research and the determination of the operating cost is that it is possible to procure authenticated records of cost, a project which was previously very much in doubt, and which many had pronounced hopeless. This fact indicates the possibility of doing a number of other things for the promotion of electric-vehicle use now also regarded as not feasible.

Another interesting fact demonstrated by the compilation is the substantial value of the investments represented in each installation. The readiness of many conservative organizations to invest in this type of equipment is the greatest proof that could be produced of the possibility of exploiting electric vehicles to a very much greater degree than has been accomplished in the past.

Nearly all of the communications received from owners contained gratifying expressions of satisfaction with their machines and with the service rendered. Only one discontinuance of them was recorded, the case being that of a horse-vehicle contractor, who found them "most unsatisfactory." In one other case, where the machines were in operation during only a portion of the year yet carried all the annual charges against the service rendered in that period, the owner considered them too expensive although he was satisfied with their performance in all other respects.

It is very evident that the general employment of some method of uniform accounting is desirable from the point of view of all interested in promoting electric vehicles—the user, the manufacturer and the central station. The value of uniform records to the owner is evident from the fact that unless he is aware of his operating cost, including latent charges as well as active charges, he may not secure from his customer or the beneficiary of his transportation service a sufficient amount to cover his expenses, including depreciation and interest. If his vehicle costs to operate, say, $8 per day, each package, case, ton or other unit function of the daily performance should refund to his organization its relative proportion of this cost. These analyses and data bring home to the owner the relative value of his equipment, and wherever they are thoroughly understood it is safe to state that there will be complete satisfaction. Complaints that machines are "no good" or "too expensive" cannot exist where this kind of information prevails and where there is any possibility of a rational utilization of the machine.

Another advantageous feature of uniform accounting would be the possibility of comparison between owners of equipment, and the beneficial interchange of information that would result would produce a tendency to lower the cost of operation to its practicable minimum.

The manufacturer would obtain the indorsement of electric vehicles by the present owners for use in convincing prospective users, and could secure diverse cost information, duly authenticated, which would be serviceable in advertising and other sales campaign activity to a greater degree than is true of any other material now available.

The central-station organizations would also be assured of concrete and specific argument for their solicitors, and would gain information of material aid in the several plans now under active consideration for possible extensive exploitation to secure the much-desired "off-peak" period load of the electric vehicle.

It must devolve principally upon manufacturers to persuade users of their product to adopt some scheme of uniform accounting. It has been found from the examination of extracts from users' books that there is necessarily great diversity in the methods of detail cost-keeping employed in various lines of business, since the specific information derived must serve many minor purposes. However, in the conduct of the project herewith outlined it has been proved that the form of statement employed, as shown in Fig. 1 and Fig. 2, would serve satisfactorily in almost every case to summarize the general review of the year's cost as the auditor or executive officer would desire the presentation. Hence manufacturers are earnestly requested to consider this form of statement as an immediately available means to offer to their clients for the general accomplishment of the purpose indicated.

Pertinent questions before the principal central-station organizations of the country at the present time relate to the desirability and value of the electric-vehicle load, the total volume of commercial-vehicle load possible within the range of their service lines, and the proportion of this potential business that could be made an actual reality by some extraordinary effort to secure it on their part. Many methods of development are under consideration. Some of these are sure to take active form without much further delay, if the existing temporary opportunity is taken advantage of in due proportion to its importance. Transition from animal to mechanical transportation of merchandise in city streets is now taking place as surely as the history of the street-railway business has proved the transition to be an accomplished fact in city rail passenger transportation. Within a period of ten years horse carriages have almost totally disappeared from the streets of the larger cities, and few can doubt that the coming ten years will develop a similar truck and wagon transformation. A question of the moment is whether or not the electric-utility organizations will be the beneficiaries of the change. With the existing degree of activity in promoting the use of electric vehicles the answer is certainly in the negative, on account of the superior enterprise and greater popularity which are forcing the gasoline machine ahead at the rate of three to one. As this progress increases, the obvious handicaps of the non-popular electric vehicle will also materially increase, and thus the present opportunity will have passed.

Many methods of securing this field of new business are available to central-station companies without departing very seriously from their present practices. The situation seems to require only initiative on the part of those empowered to do big things. Among the first necessities are facts of the character developed by this investigation. The ELECTRICAL WORLD may therefore appropriately offer the results of its work in the field of cost analysis (with its many interrelated facts as to investment and expense ratios, proved in a most reliable and authentic manner) for such use as the industry may derive from it.

Extracts from Correspondence

The following extracts indicate the character of the communications received from the owners of the installations cited:

ACKER, MERRALL & CONDIT COMPANY, NEW YORK: "The figures you have submitted are a fair representation of our records."

ADAMS EXPRESS COMPANY, NEW YORK, BUFFALO, PHILADELPHIA, INDIANAPOLIS: "The analysis of operating expense of the several electric-vehicle installations submitted is liberal, and operation results would be within these totals."

THE ÆOLIAN COMPANY, NEW YORK: "We find the statement you submit to be not far from our experience."

ANHEUSER-BUSCH BREWING ASSOCIATION, ST. LOUIS: "With few exceptions your schedules have come pretty close to our cost."

AYERS & COMPANY, INDIANAPOLIS: "The cost sheets shown are approximately correct; details figured a little differently."

BALTIMORE BARGAIN HOUSE: "The statement of cost as issued by you would seem to us to be very fair, it costing us fully 20 per cent less than the figures you give."

BERNHEIMER & SCHWARTZ BREWING COMPANY, NEW YORK: "Our experience with electric vehicles (all 5-ton machines) indicates that it cost us about $12 per day to maintain and operate the same."

BEST & COMPANY, NEW YORK: Some few detail corrections made by owner on our schedules and returned.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY: "Our costs are well under those outlined in your Schedules A and B."

BONWIT, TELLER & COMPANY, NEW YORK: "These figures are about correct."

CARSON, PIRIE, SCOTT & COMPANY, CHICAGO: "While some of the items of expense do not correspond exactly with our method of calculation, the final deductions are fairly close to our operating cost."

CENTRAL BREWING COMPANY OF NEW YORK: "Your statement of the operating cost of our automobiles is fair and liberal. Our expense is somewhat lower, except for drivers and insurance."

CLAUSEN-FLANAGAN BREWERY, NEW YORK: "We have made careful examination of your statement and find the amount for each item varies less than 5 per cent from actual expenses shown by our books."

CONSOLIDATED GAS COMPANY OF NEW YORK: "We consider these figures very fair and can operate our trucks at a cost not to exceed those set forth in your statement."

CUSHMAN GLOBE COMPANY, NEW YORK: "We believe, after examination, that your figures are, as you state, rather high than low. We can safely state that electric vehicles can be operated for or below the figures you show."

THE DELIVERY COMPANY, CLEVELAND: "Your schedule of operating cost checks very closely with our own figures."

DUQUESNE LIGHT COMPANY, PITTSBURGH: "Relative to cost analysis for electric vehicles, we have checked this over closely and have the opinion that it is fair and equitable."

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN: "Glad to advise you that figures which you submitted are very close indeed to our actual operating costs."

EDISON ELECTRIC ILLUMINATING COMPANY OF DETROIT: Copy of operating cost record furnished.

THE FAIR, CHICAGO: Statement submitted checked by owner and returned. Very little alteration.

THEO. FINKENAUER BREWING COMPANY, PHILADELPHIA: Statement submitted corrected by owner and returned with some modification.

GARDINER DAIRY COMPANY, BALTIMORE: Copy of operating cost records furnished.

GOLDENBERG BROTHERS & COMPANY, NEW YORK: "We have made an examination of the cost of operating our electric vehicles and find that you are practically correct in your estimates."

J. B. GREENHUT COMPANY, NEW YORK: "In reference to data concerning cost of operating electric vehicles, have carefully gone over same and find they are pretty well in line with experience."

HAFFENREFFER COMPANY, BOSTON: Statements submitted corrected by owner and returned.

HAMMACHER, SCHLEMMER & COMPANY, NEW YORK: Statement submitted checked with records and returned.

HARTFORD ELECTRIC LIGHT COMPANY: "The total daily operating cost on 700-lb. and 1000-lb. sizes is possibly a little low; on 2000-lb. and 2-ton vehicles we believe your figures to be more than ample."

A. B. HASTINGS & SONS, CAMPELLO, MASS.: Data furnished from operating records.

FRED. HOLLENDER & COMPANY, NEW YORK: "We are operating the specified machines at about 4 per cent less than the total you figure."

HORN & HARDHART BAKING COMPANY, PHILADELPHIA: "From what information we have at hand we believe your estimate is considerably in excess of our cost."

HOUGHTON & DUTTON COMPANY, BOSTON: Data furnished from cost records in comparison with statement submitted shows our figures slightly in excess of records.

KIPS BAY BREWING COMPANY, NEW YORK: "We have looked into the figures submitted and consider them to be fair and liberal, as proved by our experience."

LINCOLN SAFE DEPOSIT COMPANY, NEW YORK: "Our operating expense is somewhat less than your figures would indicate."

V. LOEWER'S BREWERY COMPANY, NEW YORK: "Your figures may be considered to have liberal factors of safety in them for the operation of such an installation in our service requirements."

LOUISVILLE GAS & ELECTRIC COMPANY: "Our cost of operating electric vehicles is less than shown."

R. H. MACY & COMPANY, NEW YORK: "Would say that our operating cost is within your figures, which we consider fairly representative."

MANHATTAN BREWING COMPANY, CHICAGO: Revision of our statement furnished by owner.

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY: "Concerning electric automobile operating data, our operating engineers came to the conclusion that the expenses were representative."

GEO. MUEHLBACH BREWING COMPANY, KANSAS CITY: "After carefully checking your Schedules A and B, we can say these analyses come within a few dollars of our actual cost."

NEW YORK & QUEENS ELECTRIC LIGHT & POWER COMPANY: Revision of our statement furnished from company's records.

NEW YORK TRANSFER COMPANY: "Have gone over very carefully in detail the cost analysis and compared same with our records and find the discrepancy between the two is less than 5 per cent."

PACIFIC STATES ELECTRIC COMPANY, LOS ANGELES: "It is therefore (for stated reasons) generally correct to say that our actual operating expenses exceed those shown in your statement by about $100 per machine per year."

PHILADELPHIA ELECTRIC COMPANY: Copy of operating cost record furnished.

F. A. POTH & SON, INC., PHILADELPHIA: "This comparison (furnished) shows you to be about 15 per cent higher than our figures, owing to the fact that you include electric power."

PUGET SOUND TRACTION, LIGHT & POWER COMPANY: Revision of our statement furnished from company's records.

JAMES PYLE & SON, EDGEWATER, N. J.: "We are pleased to state that in the aggregate your estimated cost closely approximates our figures."

PUBLIC SERVICE ELECTRIC COMPANY, NEWARK, N. J.: Copy of operating cost records furnished.

SCHENECTADY ILLUMINATING COMPANY: Revision of our statements furnished from company's records.

C. SCHMIDT & SONS BREWING COMPANY, PHILADELPHIA: "We beg to state that the costs sheets on the whole are nearly correct, as far as our experience of over twelve years with electric trucks goes."

SIBLEY, LINDSAY & CURR COMPANY, ROCHESTER, N. Y.: "In looking over your Schedule B we think you are nearly right."

STAMFORD (CONN.) GAS & ELECTRIC COMPANY: "We believe our cost to be considerably lower than those shown by you."

SIMPSON-CRAWFORD COMPANY, NEW YORK: "We are operating our machines slightly below the figures shown in your statement."

SIOUX CITY (IA.) BREWING COMPANY: Revision of our statements furnished from company's records.

UNION ELECTRIC LIGHT & POWER COMPANY, ST. LOUIS: Copy of operating cost records furnished.

UNITED ELECTRIC LIGHT & POWER COMPANY, NEW YORK: Revision of our statements furnished from company's records.

UNITED STATES GOVERNMENT PRINTING OFFICE: Copy of operating cost records furnished.

WASHINGTON WATER POWER COMPANY: Revision of our statements furnished from company's records.

WARD BAKING COMPANY, BRONX, N. Y.: Revision of our statements furnished from company's records.

WARD BAKING COMPANY, BROOKLYN, N. Y.: Revision of our statements furnished from company's records.

WARD BROTHERS COMPANY, ROCHESTER, N. Y.: "Our chief accountant has been over these figures and states that they are conservative and more than ample to cover cost in our operation."

WILLOW BROOK DAIRY COMPANY, MOUNT VERNON, N. Y.: "Judging from our experience, the various charges in schedules inclosed are very reasonable, and in fact we have operated at much lower cost."

WILMINGTON (DEL.) STEAMBOAT COMPANY: "Your statement of proportionate machine operating expense coincides very closely with what we have found."

WORCESTER (MASS.) ELECTRIC LIGHT COMPANY: Copy of operating cost records furnished.

Selling Trucks on the Basis of Adaptability to the Work

In a paper on "The Future of the Electric Truck," presented by Mr. P. D. Wagoner, president of the General Vehicle Company, Long Island City, N. Y., before the motor truck convention at Detroit, May 6, the author made the suggestion that motor-truck manufacturers sell trucks on the basis of adaptability to the work. As a result every satisfied consumer—satisfied because his machines showed high efficiency through specific adaptability—would thus save money and be able to buy still more trucks.

"As it is," wrote Mr. Wagoner, "the man who buys a 5-ton gasoline truck when a 2-ton electric truck is what he should have, or vice versa, frequently disposes of his truck and sticks to his horses with a set jaw. More than that, he frequently kills the immediate purchase of any motor trucks by his business friends."

It has taken courage to limit electric-truck sales to the field of specific adaptability, declared the author, but the more scientific motor trucking becomes the more electric trucks will be used, at least in city work. Specific adaptability combined with proper routing is the cornerstone of scientific trucking.

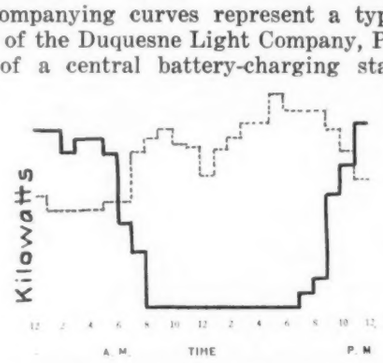
Within the last two years the experienced user of motor trucks has had a change of viewpoint. Formerly the general attitude in some cities was never to use an electric truck unless one had to, but to-day the merchant or manufacturer who insists on knowing what motor delivery costs him is figuring, and figuring to increase his percentage of electric delivery as well as his radius of electric delivery. He is proceeding on the basis of "the electric truck for city work—if," and he proceeds to eliminate the "if" as he meets it in his particular problems.

This means that while the gasoline truck "has the call," as heretofore, for long, non-stop suburban runs and where speed is a great consideration, none the less the electric truck, with economic law behind it, is becoming firmly intrenched in city service. The future of the electric truck lies in displacing the horse in the city and in working in co-operation with the gasoline truck.

"The future of the electric truck," wrote Mr. Wagoner, in closing, "is the future of electricity. Economic law will keep it in the thick of traffic near the centers of our industrial life. The electrification of our railroads takes place first, where? In and near great cities where a dense traffic makes it a success financially." Electric garages and charging stations follow the crowd, so to speak. Like Napoleon's army, which traveled on its belly, the commercial electric must stay near its source of supply. In its field, however, declared Mr. Wagoner, the electric truck is supreme, and its supremacy is rapidly being recognized.

Battery Charging a Desirable Load

The accompanying curves represent a typical daily load curve of the Duquesne Light Company, Pittsburgh, Pa., and of a central battery-charging station (the solid line). It shows most plainly that electric-vehicle charging is a load which all central stations should eagerly seek. A combination of the two curves makes a resultant curve having no deep valleys or high peaks, consequently the generating equipment and operating force can be worked at high efficiency. For every horse-power of connected load in industrial motors 50 kw-hr. to 75 kw-hr. a month is considered good business, whereas vehicle motors should require 100 kw-hr. to 200 kw-hr. per hp in the same period.



HOW THE VALLEYS ARE FILLED BY VEHICLE CHARGING

Merchandising Methods

Advertising Appliances on the Face of Customers' Bills

Electric-service bills which the Toledo (Ohio) Railways & Light Company now deliver to its customers are 3 in. longer than those formerly used. On this additional space advertisements are printed instead of being placed on the backs of the statements as heretofore. With this new arrangement of the printed matter a little more paper is required for billing, but

DON'T LET YOUR HOUSEWORK WEAR YOU OUT
Clean your home with an
ELECTRIC VACUUM CLEANER
And Banish Drudgery
Just a Twitch of the Switch
TRIAL FREE! SOLD ON SMALL PAYMENTS
DISPLAY ROOM
TOLEDO RYS. & LIGHT CO.

THIS REMINDER APPEARS ON THE FACE OF THE CUSTOMERS' BILL

it is necessary to run the bills through only one printing process, and hence the long bill forms cost little more than would smaller ones printed on one side. The new scheme has the advantage of enabling the company's advertising manager to place timely advertisements where every customer of the company must see them.

Talk Merits of Your Goods First—Price Last!

An executive of a large electrical manufacturing company who some time ago devoted his entire personal attention to the rebuilding of his company's plant, an operation extending over two years, recently expressed himself as having felt well repaid for the time and effort expended, on account of the opportunity thus afforded him to observe the methods adopted by salesmen.

"Ninety-five per cent of the salesmen who called to sell something for that plant," said he, "seemed to know nothing about their business except the price of their goods. Furthermore, they seemed to think that the only way to get an order was to sell for less money than we could buy for elsewhere. As a matter of fact, in our case, we were building a plant as an investment, we expected to do business in it as long as we lived, and we were not looking for the cheapest thing, but for the best thing.

How Price-Cutting Policies Lost Orders

"Salesman after salesman lost an order because he had no ability except to quote a price and immediately to cut that price if he did not get the order at once. On the other hand, a few salesmen—not more than one in twenty—would not talk price at all until they had exhausted the subject of the quality and merit of their goods from an investment point of view.

"Although our buying policy may be different from some, at the same time the salesman who knew his business and believed in his goods always got the order, no matter if his price was high. In fact, the fellow who did not cut his price at all—and thereby showed the same confidence in his price that he did in his product—got the order 'hands down.'

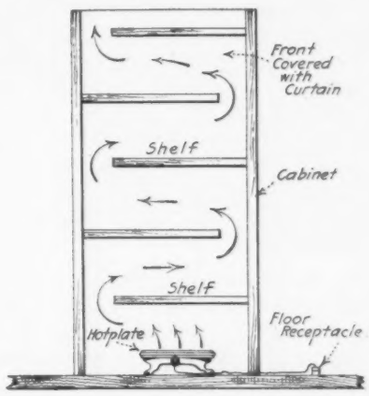
The Best Is Cheapest in the End

"We have had experience enough to know that anything we put into a permanent building may cost us twice what we can save in price, provided that what we buy is right and does not have to be replaced. Every time we have bought anything on price there was something the matter with it, and when we came to replace it the cost was from two to three times as much as we had expected to save in purchasing the cheaper material.

"For these reasons the man who knew his business, sold his goods on their merit, and believed in himself, in his goods and in his prices, did business with us. The fellow who did not know his goods and had no confidence in his prices did not do business with us simply because we had no confidence in him."

Hot-Plate Used to Dry Photographic Plates

A commercial photographer in Kansas City, Mo., who makes rapid finishing work his specialty, uses an electric hot-plate to aid in drying photographic negatives and prints. The hot-plate is placed beneath a rack de-



A KANSAS CITY PHOTOGRAPHER'S DRYING CABINET

signed to hold plates or films, or even prints, and with three sides of the rack built with solid walls and the fourth closed by a curtain the heated air circulates over all of the shelves and escapes at the top of the cabinet.

Encouraging Non-Commercial Employees to Secure New Customers

A handy electric vacuum cleaner which is sold at retail for $19.50 is to be given to the employee of the Louisville Gas & Electric Company who during May turns in the greatest number of names of prospective customers with whom service contracts are closed before June 1. Other domestic devices will be awarded as prizes to employees who turn in lesser numbers of new customers' names.

Employees who succeed in interesting friends or acquaintances in the house-wiring offer on which particular sales effort is now being concentrated are required only to telephone the names of such prospective customers in to the commercial department of the company. The names of both the employee and the prospective customer are there recorded, and the "pros-

pect's" name, with his address, is turned over to the company's regular solicitors. During the present month an especially low price has been made for the wiring of four-room cottages, and free electric service is also given for one month on all contracts signed before June.

Leasing Motors a Successful Policy

In the ELECTRICAL WORLD of March 27, page 805, was outlined a plan of leasing motor installations on a trial basis as practised by C. D. Parker & Company, Boston, Mass. Figures are now available covering eighteen months' experience with this plan in one of the central stations managed by this house. On this property twenty-four installations of motor equipment were made, the total rating being 1002 hp. The investment complete was $21,233, including motors, starting apparatus, wiring, and such shafting and belting as were required to make the drives in each case properly adapted to the work involved. The total yearly revenue from energy sold to these motor installations is $19,146. All of the apparatus was furnished by the central station, the customers paying 15 per cent of the first cost, with the motors at list price, as rental. Seven of the customers have now paid back $5,997, leaving a balance of $15,236, on which the company is receiving 15 per cent interest, subject to reductions in the principal as the customers decide to purchase their installations. The consumers also pay the insurance charges on the installations. In case a customer buys his motors during the first year, he is credited with 9 per cent of his installation cost, so that a small factory with a motor drive costing $1,500 would have to pay only $1,365 in buying the equipment inside the first twelve months of service. The annual rental charge of 15 per cent is made up of 6 per cent interest and 9 per cent depreciation. It has been found desirable to stencil the name of the central station on motors leased in this way and also to obtain a release from the mortgagor in case the equipment goes into a mortgaged building.

Advertising a 4-Cent Electric Cooking Rate

Under a new rate schedule which recently went into effect at McPherson, Kan., a rate of 4 cents per kw-hr. has been established for energy used for electric heating and cooking. The consumer using energy for cooking also has the privilege of operating any other consuming apparatus, except lamps, at the 4-cent rate.

At the time the new rate was inaugurated a three-day demonstration of Hughes ranges was held; free shows were given in the local motion-picture theaters, using reels demonstrating the conveniences of electricity about the house, and advertising space was purchased extensively in the local daily papers. As the result a dozen contracts for stoves were signed.

Since the community has no gas or domestic coal, Mr. Arthur Groesbeck, superintendent of the lighting plant, expects to connect a large percentage of the plant customers for electric cooking within the year.

Simplifying the Refunding of Customers' Deposits

The accounting department of the Philadelphia Electric Company has inaugurated an improved method for handling consumers' guaranty deposits. At the time the deposit is made with the company's representative the duplicate copy of the guaranty deposit certificate is given to the consumer. Later, when a refund is desired, this certificate, properly signed, may be cashed in any of the company's district offices.

THE SMALL-CUSTOMER PROBLEM

Developing Revenue-Producing Business from Present Unprofitable Users

Small consumers may be divided into two classes—those who cannot afford to use more energy, even if shown opportunities of applying it, and those who can be developed into larger users when shown how they can employ electricity to their advantage. The first class, according to the paper presented by Mr. A. D. Dudley, of the Syracuse Lighting Company, Syracuse, N. Y., May 8, before a joint meeting of the Empire State Gas & Electric Association and the Eastern New York Section of the National Electric Light Association, at Schenectady, is unprofitable because it costs more to serve these customers than is received from them in revenue.

At Syracuse, where the minimum charge is only 50 cents, about 10 per cent of the consumers use less than the minimum amount. This indicates the necessity of companies analyzing their ledgers to see which consumers should be induced to use more energy. Such development is less expensive than interesting persons who own or live in unwired houses, because in the former case no meters or service lines have to be installed. Among methods of increasing consumers' loads were suggested conducting extensive appliance campaigns, keeping energy-consuming devices in operating condition by maintaining a repair department, and demonstrating appliances in homes. The speaker suggested that central stations maintain electric signs to insure their being used continually. Before appliance-sales campaigns can be effective a company must be sure that it is handling the products which will satisfy the consumers, that it is offering an attractive price, and that it is paying its employees well enough to cause them to put spirit into the campaign. In handling small consumers, like occupants of small offices, Mr. Dudley recommended renting the meter or at least limiting the minimum bill.

Discussion

The paper provoked an interesting discussion in which the following took part: Messrs. G. T. Macbeth of Mount Vernon, H. W. Peck, L. H. Scherck, C. G. M. Thomas of Long Island City, T. I. Jones of Brooklyn, A. T. Throop of Utica, E. H. Palmer, E. M. Ellsworth of Schenectady, W. D. Hodgson of Glens Falls, C. F. Brunt of Geneva, W. L. Secord of Mount Vernon, C. A. Greenidge of Ithaca, and F. G. Vaughn of Schenectady.

Mr. Macbeth pointed out that poor people cannot afford to become large consumers, but they should nevertheless be offered rates which will induce them to use electricity.

Mr. Peck declared that there are only 417 unwired houses in Schenectady, which has a population of nearly 75,000. Most of these are tenement houses, which would not be desirable on the lines as the tenants are changed so frequently. The revenue per capita is very high, being about $6.63 per inhabitant per year. Conditions make Schenectady a desirable city for selling energy, but education will have the same effect. The minimum charge is 50 cents per month, and the general rule for line extensions is one pole-span per customer. If more spans are installed, the customer is required to pay at the rate of $17 per pole-span, but is reimbursed as new customers are added. Extension of mains might be based on estimated yearly revenue as is being done by the gas department. Considered pro rata, it costs about $12 a year to maintain a single service connection in addition to the readiness-to-serve charge. While about 3200 of the Schenectady consumers pay less than $12 a year, Mr. Peck recommends giving the small con-

sumer the advantage on rates, feeling that what is good for the individual is good for the community.

Mr. Scherck expressed the belief that companies are not required to extend their mains unless a return on their investment is guaranteed to them.

Unprofitable Central-Station Customers

Mr. Jones declared that every company has its unprofitable consumers, there being about 7000 in Brooklyn, 30,000 in New York City and 50,000 in Chicago. He divided them into three classes: Those able to pay more money if shown how to utilize more energy, those who want a reduction in rates before they will increase their consumption, and those who cannot afford more than they are now spending. He pointed out that many of these can be attracted by making a meter rental charge—a method sustained by ex-Public Service Commissioner Maltbie—and charging for the energy used at an extremely low rate. The fixed cost of serving a customer, not including the charge on generating equipment, is about $7.25 in Boston and $8 in Buffalo. In estimating the readiness-to-serve charge, residence service peaks can be safely assumed to be 89 per cent of the total peaks. Mr. Jones advocated meter rental, minimum guarantees and minimum charges, rentals to be based on the meter rating.

To induce owners of bungalows at Coney Island, L. I., to use electricity during the summer months the Brooklyn company is contemplating installing relatively inexpensive load-limiting devices and making a flat-rate charge which will be required in advance for the entire season. With this arrangement the consumers will not have to be "carried on the books" and no billing will be required. A charge of $1.25 a month will be made for energy supplied through a 100-watt load limiter. This rate is sufficient to protect the company in case lamps are left burning and make it undesirable for meter users to change to load-limit service.

Mr. Throop expressed the belief that consumers once secured should not be limited in the amount of energy they may use, but should be encouraged by suitable rates to become large consumers.

Mr. Palmer suggested that a fixed charge plus an energy charge is the best form of rate for causing a small consumer to become a large one.

Mr. Ellsworth pointed out that 609 of Schenectady's 12,000 electrical consumers pay only the minimum charge of 50 cents a month, while 2504 pay $1 or less, 6523 pay $3 or less, and 3600 pay over $3.

Mr. Peck pointed out that the cost of the energy that may be wasted under flat-rate conditions may be less than the expense of reading meters and handling bills.

Mr. Scherck suggested that all companies analyze their rates to see if they can be reduced.

Mr. Brunt expressed dissatisfaction with the plan of using load limiters and flat rates to attract small consumers, saying that so many meter users in Geneva demanded to be charged on the load-limit-rate basis that the use of limiters had to be discontinued. The charge per 100-watt load limiter was $1.25 a month and the maximum lighting rate was 14 cents per kw-hr. To explain the condition which arose, Mr. Jones said that the meter rate probably was too high in comparison with the flat rate. He advised making the flat rate higher than the meter rate.

Mr. Palmer expressed the belief that load limiters also limit the possibilities of a consumer growing. In Hartford, Conn., he declared all of the load limiters formerly employed have been removed.

Mr. Greenidge spoke of using 400 to 500 load limiters in humble homes and charging 1 cent per rated watt per month, the rating of the limiter being selected by predetermining the demand. He declared that the field for excess-load indicators is with consumers who cannot afford to spend much. Consumers who can afford to pay more should be developed.

Mr. Vaughn declared that the load limiter is a method of enticing business, but it is conducive to waste unless consumers are required to purchase their own lamps and are instructed that long-hour burning shortens their useful life. No comparison can be made between European practices and those in this country because conditions differ.

Mr. Peck suggested placing load limiters on lighting circuits, but not on flatirons or other devices consuming a large amount of energy and which will furnish a diversified load.

An Exhibition "Kink" for Demonstrating Small Motors

At a recent state electrical convention a motor manufacturer's agent mounted two 1/6-hp motors on top of a 2-hp motor and aligned pulleys on the shafts of each machine so that an endless belt ran over all three in triangular fashion. One of the 1/6-hp motors was of the ordinary split-phase type, and the other was a repulsion-type machine which had been on the market but a short time. To demonstrate the lower starting current taken by the repulsion-type motor the agent connected the service wires to the machines through a double-throw switch and an ammeter. When one of the small motors was started the other small motor and the larger motor became the load. By starting first one small motor and then the other, and observing the wide difference in the swing of the ammeter needle, the demonstrator was able to show operating men visiting the exhibit the comparative values of the starting currents taken by each of the small machines.

A THREE-MOTOR COMBINATION THAT ATTRACTED ATTENTION

For an "Electrical Building" at Kentucky State Fair

A permanent ten-thousand-dollar electrical exhibition building for the Kentucky State Fair Grounds at Louisville is being promoted by Louisville Jovians. A similar project was discussed last year, but, owing to a late start, the plan was not completed before the fair opened in September. Now, however, local electrical men are working on plans for the erection and equipment of a structure to constitute part of the regular housing equipment of the fair association. According to Mr. Robert Montgomery, who is at the head of the movement, it is proposed to show in the building various modern uses of electricity for light, heat and power.

Interior Construction

ELECTRIC WIRING—II

Selection of Conductor Sizes—Proper Allowance for Drop in Lines

BY GEORGE C. SHAAD

Of the two materials which are used to any great extent for electrical conductors, copper and aluminum, the former is used almost exclusively where the conductor is to be insulated. For a given current capacity the cross-section of the aluminum conductor must be greater than that of the copper wire, and the lesser expense for insulation makes the copper conductor preferable. The flow of electricity through a conductor produces two effects of interest when considering a wiring installation, namely, the heating of the conductor and the drop in voltage along the conductor. If the temperature of the wire becomes too high, the insulation is liable to become deteriorated. The allowable safe current-carrying capacity of wires for permanent installations is set forth in the National Electrical Code. In ordinary installations, not including long alternating-current feeders, the drop in voltage along the wire may be calculated directly from Ohm's law; that is, the current equals the voltage divided by the resistance, or the voltage drop equals the resistance multiplied by the current. The conductor system, then, must conform to the National Electrical Code as regards the current carried by a given size of wire if it is to be a safe and permanent installation, and the resistance must be so

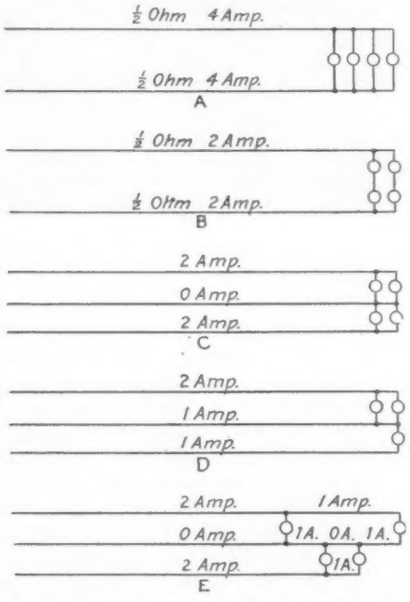


FIG. 2—DEVELOPMENT OF PRINCIPLE OF THREE-WIRE SYSTEM

low that the voltage drop will not be great enough to interfere with the satisfactory service from the incandescent lamps.

Wiring Systems

The installation of an electrical wiring system in such a manner as to avoid fire risk does not insure that it will be well adapted to the service it is to perform, and the matter of general wiring design is largely independent of the National Electrical Code. Aside from the polyphase systems for motor drive, there are only two general systems to be considered in the United States, namely, the two-wire system and the three-wire system. The two-wire system is used for the final branches of the three-wire installations, and the use of the three conductors is reserved for the portions of the system where the current is relatively large and where the load can be fairly well balanced between the two sides of the three-wire system. The two-wire system requires no general explanation, but the three-wire system and the object of its use are not so generally understood and they will be given some further consideration.

Referring to Fig. 2, assume a 110-volt, two-wire, direct-current system supplying a load of 4 amp over a conductor having a total resistance of the two wires

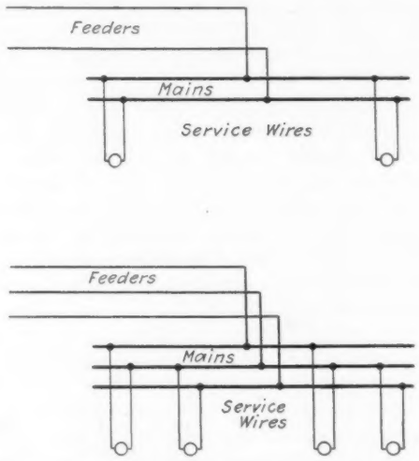


FIG. 3—ARRANGEMENT OF FEEDERS AND MAINS

of 1 ohm as shown at *A*. The total drop in voltage between the feeding point and the load will then be 4 volts. The same system using two 110-volt lamps in series and 220 volts at the load is shown at *B*. For the same number of lamps the current carried by the wires will be only 2 amp and the voltage drop between the feeding point and the load will be only 2 volts. Expressed in a percentage of the total voltage, the drop in the second case will be one-fourth as great as in the first case, or for the same percentage drop in voltage the resistance can be four times as great or a wire of one-fourth the size can be used. The use of 220-volt lamps and devices is not always desirable and the use of two 110-volt units in series at all places where a load is connected is not always convenient, but it is practicable, by means of suitable apparatus at the generating station or the proper connection of transformers, to obtain a neutral point on the 220-volt system—that is, a point where the potential to either of the wires is 110 volts. A third conductor being run from this point, the 110-volt lamps or other electrical devices can be connected between either of the outside wires and this neutral conductor. In Fig. 2 at *C* the lamps are shown connected at the same points and the neutral conductor carries no current and is not necessary. At *D* the number of lamps on the two sides is not equal and the neutral conductor carries a current equal to the difference between the currents in the two outside wires. At *E* the number of lamps on the two sides of the system is the same but they are not placed at the same points and there is a current in the neutral conductor at some points, but the major portion of the neutral wire carries no current. The introduction of the third wire provides an installation nearly as flexible as the two-wire system, and where the neutral conductor is made of the same size as the outside wires and the load is fairly well balanced there is a saving of five-eighths of the amount of copper when the regulation of voltage is to be the same as that of a two-wire system. In many

cases the saving in copper more than counterbalances the disadvantages of the three-wire installation.

The disadvantages may be summed up as follows: The system is more complicated, requiring special apparatus or special transformer connections for securing the neutral point; there is some additional expense for cut-out boxes and fuses; care must be exercised in balancing the load, and some difficulties are encountered in the testing of the installation. Where the low-tension system is of the three-wire type and a permanent ground connection is installed, the connection is made on the neutral conductor, thus limiting the possible potential to ground to about 110 volts.

"Feeders and Mains"

All modern wiring systems are laid out on what is called the "feeder and main" plan. The term feeder is applied to the relatively long conductors across which no electrical devices are connected. The feeders are attached to the mains, and from the mains the service wires are run to lamps, motors or heating devices as the case may be. Fig. 3 is a simple diagram showing both the two-wire and the three-wire systems. In cases where the conductors are kept the same size throughout the system, which condition applies in practice to only the very small installations, the system is said to use cylindrical conductors. Where the size of wire is changed occasionally so as make the current density—the current per unit cross-section of the conductor—approximately uniform, one speaks of the system as using tapering conductors. The use of "tapering" conductors allows a better voltage regulation for the same amount of copper, or for the same voltage regulation allows a saving in copper over the use of "cylindrical" conductors, so that in all of the larger installations there is a reduction in the size of the mains from the feeders to the more remote loads on the system. Special arrangements of the feeders and mains are sometimes encountered, such arrangements being for the purpose of saving in the amount of copper or improving the voltage regulation. One of these, known as anti-parallel feeding, consists in connecting the feeders to opposite ends of the mains. According to a second plan, known as the ring system, the mains are so connected as to form a closed loop and the feeders are connected either to the same point or to opposite points on these rings. It is seldom convenient to install the special systems, and in the majority of cases the ends of the mains are open and the feeders are connected to the mains at the same point. Care is taken, however, to see that, as far as practicable, the feeders are connected to the mains at such a point that the drop in voltage from the feeding point to one end of the main is about the same as the drop to the other end of the main.

Electric-Iron Load Determines Transformer Sizes

Surveys to determine the adequacy of residence customers' transformer installations on the lines of the Citizens' Light, Heat & Power Company of Canby, Minn., are always made on Tuesday mornings. At that time it has been observed that an average of eight of each ten customers are using 500-watt electric irons. Since 500 watts is considerably above the average lighting load imposed by individual residence customers in Canby, the probable number of electric irons to be used in a district—rather than the probable number of lamps—is now taken as the correct guide to the proper transformer size. According to Mr. E. W. Erick, president and manager of the Canby company, this method of estimating necessary transformer ratings has proved to be very successful.

Lighting Practice

Improving Lighting Conditions in Municipal Buildings

Inefficient lighting inherited from the time when the carbon-filament incandescent lamp was the standard interior illuminating equipment may be found in many municipal buildings. The modernization of public-building illumination offers in many cities an attractive field for engineering enterprise. A campaign along this line was begun at Boston, Mass., not long ago, under the direction of the department of public buildings, and the resulting improvement in five structures owned by the city saved the municipality $314 in the month of December, 1914, compared with the same month of 1913. Among these buildings were three armories and a branch of the public library, all of which are supplied with electricity by the Edison Electric Illuminating Company of Boston.

In general, the work has proceeded in the direction of replacing numerous small and inefficient lamps by a few larger units of the tungsten type, although in each case the specific needs of each building have been gone over in a preliminary way. It has been found helpful in many instances to substitute two 60-watt tungsten lamps for half a dozen or more carbon lamps in multiple fixtures, insulating the sockets from which all but two of the old lamps were withdrawn so that only two high-powered units can be used, and this without imposing any noticeable expense upon the city for making the change. Sixty-watt lamps are renewed free of charge by the Edison company, and it has been found in many rooms that two of these give much better light than from six to ten 16-cp carbon lamps, even though the fixture outlets may be left unused in part. The socket insulation is effected by a properly designed cardboard washer painted brass color to avoid attracting the attention of persons tempted to utilize sockets in the blank, and thus to nullify the good work of the department.

Effecting Economies by Care and Study

Other economies are being effected by a more careful study of rates and demand conditions in different buildings, by the re-arrangement of meters, and notification of the company once a month of the intention in armories and other public buildings to exceed the normal maximum demand. It has been found in many cases that the installation of a 25-watt or a 40-watt lamp in a swinging bracket fixture for desk or typewriter stand service far exceeds in quality of service dependence upon a general scheme of overhead illumination of a sufficient intensity to permit reading and writing without eye strain, and that it accomplishes this object at reduced cost.

Officials of the Edison company have expressed themselves as heartily in favor of the efficiency work of the department, contending that any steps which yield better service at lower cost are sure in the long run to popularize central-station energy to a greater degree. The department has not as yet had occasion to attempt to study lighting improvements on the foot-candle basis, in view of the large number of buildings in its care and the importance of cutting down the excessive consumption of energy before striving after more refined economies. The work has been so successful that Mayor Curley has requested that the electrical engineer of the department, Mr. John F. A. Swift, devote his entire outside time in the present year to improving the lighting of buildings in the school, police and fire departments.

The Recent Trend in "White-Way" Lighting

Five-lamp "white-way" standards have fallen into disfavor of late, said Mr. Ward Harrison, of Cleveland, Ohio, in a recent address at St. Paul, Minn., because in the daytime such posts assume too much prominence in the streets. Preference to-day inclines toward a single-lamp unit or a post having two lamps at most, the illuminants used being comparatively high candle-power lamps of either the incandescent or the magnetite-arc types.

In small towns it has frequently been found desirable to confine the light to angles below the horizontal in order to concentrate the attention of the observer upon only the first story of the building. In such towns most of the stores are often made-over houses extended out to the street. The general appearance of the lower part of the buildings is good, but the choice of illuminants which would draw attention to the upper and less attractive parts of the buildings by lighting them brightly would often make the effect less pleasing by night than it is in the daytime. On the other hand, in illuminating important business streets of large cities where the buildings themselves are impressive a considerable amount of the light should be directed upward to reveal the façades of the structures.

Interior Decorative Lighting Adds to Demand of Modern "Movie" Theaters

With its spectacular "front lighting," arc-projection apparatus, long-hour auditorium lamps and ventilating motors, the modern "movie palace" offers a most diversified demand for central-station service. Electric pianos, organs, violins, and even whole orchestras, are now reducing operating expenses in many up-to-date cinema houses.

There is a tendency nowadays toward more artistic lighting and decoration of the interiors of the auditoriums of the recently constructed picture houses. The eye is properly being accorded something more agreeable to rest upon during changes of pictures than the blank screen in front. An example of such an attractive interior is that of the Harvard photo-play house at the corner of Harvard Avenue and Sixty-third Street, Chicago, illustrated herewith.

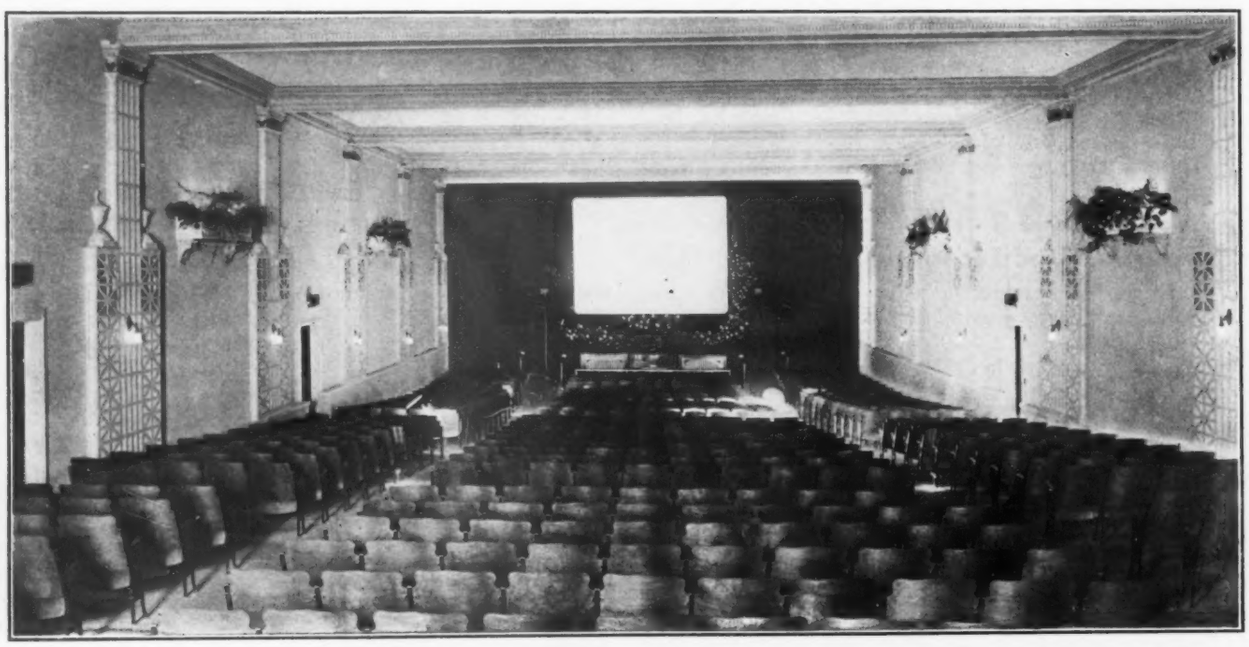
Framing the picture screen ahead is a great branch of artificial roses, each flower being marked with a small tinted lamp. Another novelty is seen in the combination indirect-lighting fixtures and flower baskets along the walls near the ceiling. These concealed lighting units project a low-intensity illumination on the ceiling, from which the aisles and rows of seats are lighted sufficiently for the late comer to find a vacant place, but without distracting the attention of the audience. Such "dark-house" illumination is required, it will be noted, chiefly at the rear of the auditorium, as the front is usually well lighted from the screen itself.

Illuminating the Playground

A playground is generally in use only from the early hours until dusk, when the darkness prevents all from playing. The Park Commissioners of Oakland, Cal., realizing that the usefulness of a playground would be increased by adequate illumination at night, decided to make a trial installation in Mooswood Park. Here, among ravines and other natural beauty, is hidden a playground consisting of baseball and football fields, tennis courts, volley-ball and basket-ball courts, and the usual horizontal bars, flying rings, trapezes, ladders, toboggans, swings and sand boxes.

Mr. George R. Babcock, superintendent of the city's Electrical Department, after a careful consideration of the multiple-flame arc, the series magnetite arc, the series carbon arc, the series tungsten lamp and the gas-filled tungsten lamp, decided to use the latter to illuminate the playground. The football field was equipped with five 750-watt units, while 1000-watt units were installed to illuminate the swings and gymnasium apparatus. These units are placed on goose-neck boulevard posts 20 ft. above the ground, connected to the mains of the Pacific Gas & Electric Company. A general illumination of the paths and walks is obtained by means of 150-watt multiple-type, gas-filled lamps mounted on existing gasolier posts which were cleverly re-designed for taking a single electrical unit.

The success of the undertaking was assured from the opening night. The attendance of men, women and children of all ages during the dark hours has been greatly increased.

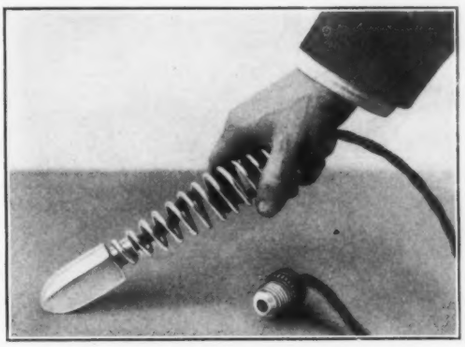


DECORATIVE LIGHTING IN A CHICAGO "MOVIE" PALACE

NEW APPARATUS AND APPLIANCES

Electrically Heated Shoe-Treeing Iron

The electrically operated shoe-treeing iron or "Calorel" re-laster, as it is called, which is shown herewith is designed for use in retail shoe stores and can be operated from an ordinary lighting socket. It consists



ELECTRIC SHOE-TREEING IRON

of three parts rigidly fastened together—the highly polished brass tip, the heating element, and the handle, which is of nickeled-steel wire. The brass tip weighs 1 lb. and is able to store a comparatively large amount of heat. The device is equipped with 10 ft. of flexible cord and a detachable plug, and takes 80 watts. It is being made by the Fearn Company, Baltimore, Md.

Ventilator for Mixing Outdoor and Indoor Air

A motor-driven ventilator which takes air from both outdoors and indoors and which blows air to the ceiling where the warm air tends to rise is shown herewith. The device consists of a Westinghouse-Sirocco blower and a combined duct and mixing chamber for bringing outdoor or indoor air or a mixture of the two to the blower. When the slide in the duct is brought forward and the duct is closed to the room, the blower draws only cold outdoor air; when it is pushed back, the supply of cold air is cut off and the air from the room is recirculated.

MOTOR-DRIVEN VENTILATOR FOR INTERMIXING AIR

When, however, the duct is partly opened, as shown in the accompanying illustration, air is drawn both from indoors and outdoors. The ventilator is being placed on the market by Gerdes & Company, 30 Church Street, New York.

Small Motor-Generator Set

Motor-generator sets with ratings of 75 watts, 150 watts and 300 watts, consisting of a direct-current generator and either a direct-current or an alternating-current motor, are being made by the Electric Specialty

MOTOR-GENERATOR SET FOR BATTERY-CHARGING AND SIGNAL WORK

Company, Stamford, Conn. The sets are designed for use in charging small storage batteries and for operating signals. The armatures of both the motor and the generator are mounted on the same shaft, which is supported by large oil-ring bearings. In the accompanying illustration is shown a direct-current generator connected to a direct-current motor.

Electrically Operated Machine for Sharpening Razor Blades

A motor-driven machine designed for sharpening twelve safety-razor blades at one time and ten dozen blades an hour is shown in the accompanying illustration. The blades are held by steel-spring jaws which are compressed by a toggle joint. Pressure of the thumb lever forces the jaws together; to remove the blades the lever is raised. The blades are sharpened by a roller against which they are held by the spring jaws. Four rollers are provided, and as they revolve they also oscillate back and forth. There is no possibility, it is declared, of their being worn unevenly. By

MACHINE FOR SHARPENING SAFETY-RAZOR BLADES

means of a set-screw adjustment the blade can be placed at any angle, giving any bevel to the blade desired. Two of the rollers are provided with an abrasive covering for use in honing nicked blades. As the machine is finished attractively, it is well adapted for display in show

windows. The sharpener is equipped with a 1/6-hp motor manufactured by the Robbins & Myers Company, Springfield, Ohio, and it is being placed on the market by the Hyfield Manufacturing Company, 48 Franklin Street, New York.

Extension Attachment for Pull Switches

In the accompanying illustrations is shown an extension attachment for pull sockets and rosette pull switches, developed by the Arrow Electric Company,

EXTENSION ATTACHMENT

Hartford, Conn. The extension is provided with a special brass finish. Six feet of black cord is provided for the device when used with the pull socket, and 10 ft. of black cord when used with the rosette pull switch.

Clamps for Stranded Wire

Various types of clamps for stranded wire, designated as Marchand clamps, have been developed by the Steel City Electric Company, 1207 Columbus Avenue, Pittsburgh, Pa. In Fig. 1 is shown a clamp of the clevis type

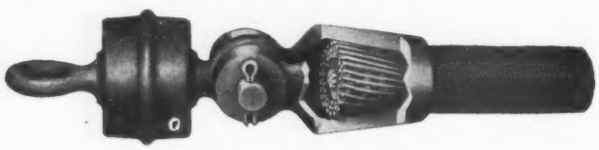


FIG. 1—CLEVIS CLAMP ATTACHED TO STRAIN INSULATOR AND CLAMPING END OF 1,000,000 CIRC. MIL STRANDED-COPPER CONDUCTOR

for stranded copper and aluminum conductors. The clamp proper consists of a conical-shaped socket and a conical wedge. The conical wedge is slotted to allow compression and has a hole through the center for the

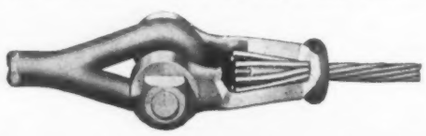


FIG. 2—CLEVIS CLAMP ATTACHED TO ANCHOR ROD

core or center wire. The strand is first inserted in the socket and the tapered plug is forced over the core or center wire so that the sheath wires are spread apart as shown in Fig. 1. The cable is then drawn back into the socket by the cable strain, the tapered plug compresses

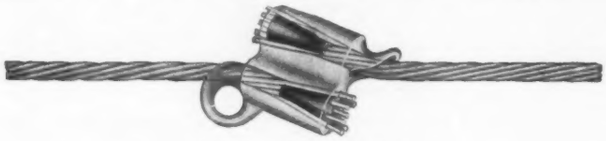


FIG. 3—TWIN CLAMP

and grips the core wire or wires, and the sheath wires are gripped or wedged between the tapered plug and the wall of the socket.

A clevis clamp, a twin clamp and a pole clamp for seven-wire strands are shown in Figs. 2, 3 and 4 respectively. These clamps are particularly adapted for use, the manufacturers declare, with guy wires, messenger wires and trolley span-wire construction. The size of the conical wedge or tapered plug and hole through the center varies according to the size of wire to be used.

FIG. 4—POLE CLAMP SHOWN WITH GUY WIRES INSERTED

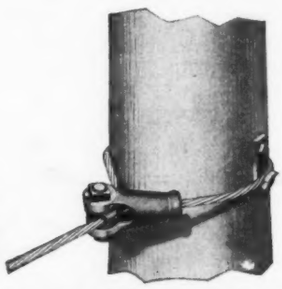


FIG. 5—CLEVIS CLAMP AS A POLE FASTENING WITH SADDLE THIMBLE

When the clevis clamp is used as a pole fastening, a saddle thimble is provided as shown in Fig. 5. The bolt passes through this thimble which prevents friction of the guy wire against the bolt. The saddle thimble permits automatic adjustment of the clevis to the proper angle of pull, thus equalizing the strain at each side of the pole. The twin clamps are designed especially for fastening guy wire to strain insulators and for splicing. They consist of a double-tapered socket casting and two tapered plugs and are so constructed that one side of the clamp pulls against the other. Twin clamps can also be used effectively, it is declared, with pole clamps, the wire being passed through instead of around the pole. For this purpose the hole in the pole is only 1/16 in. larger in diameter than the size of the guy wire to be used.

Submarine Photographic Apparatus

Apparatus has been developed by Mr. Charles Williamson and his two sons of Norfolk, Va., for taking either stationary or moving pictures under water. For this purpose a collapsible accordion-like submarine tube of waterproof canvas and rubber, 3 ft. in diameter, is

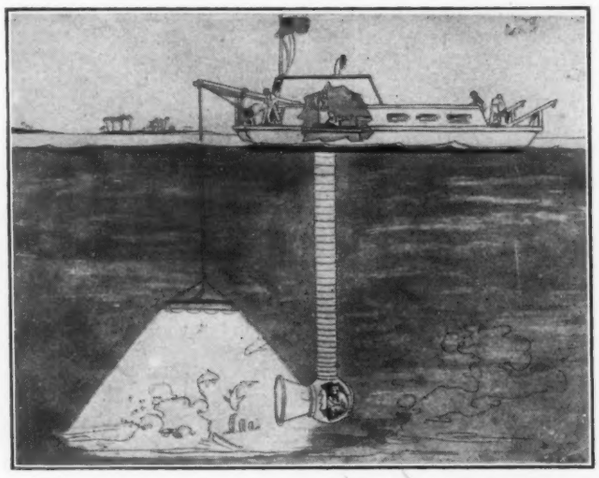


FIG. 1—APPARATUS FOR TAKING PICTURES UNDER WATER

used, braced at regular intervals by iron rings. By means of this construction a person can pass down the tube, while its flexibility permits it to be dragged along by a vessel. The top of the tube remains open at the deck, and the lower end extends down into the water and

is expanded into a chamber about 5 ft. in diameter, one side of which is provided with an observation window of heavy glass through which the pictures are taken. The space in the chamber is sufficiently large to hold two men, one of whom operates the camera while the other controls the movement of the tube, which is effected by chains operated from the deck of the boat.

For illuminating the objects to be photographed a battery of nine 2400-cp Cooper Hewitt quartz-tube lamps is suspended from the boat, as shown in Fig. 1. The essential parts of each lamp are the quartz burner and the auxiliary. The former comprises the light-giving tube, its support and the enameled reflector, while the latter consists of the necessary tilting mechanism and coils for starting and maintaining the mercury arc. In ordinary commercial use the burner is

FIG. 2—ILLUSTRATION OF PHOTOGRAPH TAKEN OF DIVER

suspended from the lower part of the auxiliary and is inclosed in a glass globe, but for submarine work the auxiliary is kept on board the boat, and the burner with its reflector holder is mounted in a casing which is placed in a frame and lowered into the water. Photographs and moving pictures have been made through the water by the method described for a distance of 100 ft. In Fig. 2 is shown an illustration taken from a photograph of a diver exploring an old wreck of a ship 50 ft. distant from the camera.

Steel Lighting Standards for Outlying Districts

For use in outlying sections of cities and for villages, where heavy and elaborately ornate iron lighting standards are not considered appropriate, a new type of street-lighting post has been brought out by the Carbo Steel Post Company, Inc., of 538 South Clark Street, Chicago, Ill. Two angle irons welded together to form a square shaft compose the upper portion of the post. The top of the standard is equipped with an ornamental cap and a standard 8-in. fitter which will carry diffusing globes of all regular sizes. From the ornamental cap to the ground line the post measures 10 ft.

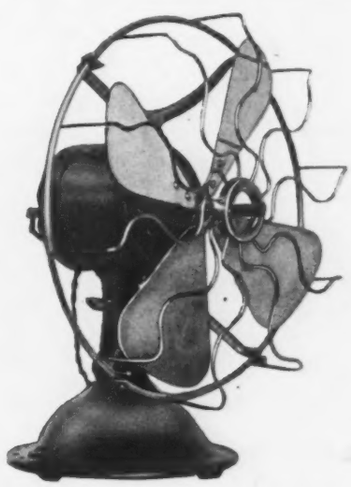
Beneath an ornamental base at the sidewalk line is a patented anchor base which extends 30 in. into the

STEEL LIGHTING POST

ground. The triangular plate at the lower extremity of this anchor base measures 12 in. on a side. To set the post, therefore, an excavation 12 in. in diameter and 30 in. deep is sufficient. The manufacturers of this post state that it need not be set in concrete and that the use of special tools for setting it is unnecessary.

Twelve-Inch Fan

A 12-in. fan designed to operate on either alternating current or direct current has been developed by the Menominee Electric Manufacturing Company, Menominee, Mich. The bearings are of bronze and oiling is

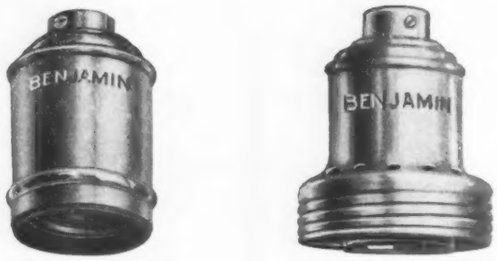


TWELVE-INCH FAN OPERATING ON EITHER ALTERNATING CURRENT OR DIRECT CURRENT

accomplished with wick feed. The fan can be furnished in either the fixed or the oscillating style, and can be used either on the desk or table, or it may be mounted on the wall. The motor operates practically at the same speed on alternating current as on direct current.

Socket with One-Piece Shell

Two styles of sockets equipped with one-piece shells are now being marketed by the Benjamin Electric Company of 120 South Sangamon Street, Chicago. One type with the regular form of bead at the receptacle end of the socket is intended to accommodate a standard shade



FIGS. 1 AND 2—BEADED AND THREADED SOCKETS

holder, while the other is expanded at the receptacle end and is threaded so that holders of a special type can be fitted to it. The interior mechanism of the socket is held in position by two screws which the wireman in connecting the socket must remove from the receptacle end of the device. The entire interior mechanism of the socket need not, however, be removed completely from the shell by the wireman, as the screws are arranged so that a few turns release them from their permanent position and allow the interior porcelain connector and switch base to drop down into an accessible position. The socket is rated at 660 watts and 250 volts, and has been approved by the Underwriters' Laboratories.

Instrument for Finding Defects in Cable Circuits

An instrument has recently been developed by W. N. Matthews & Brother, St. Louis, Mo., which is designed for locating faults in telephone, telegraph, signal and electric transmission circuits, and for locating pipes underground, and concealed wires and metal pipes in ceilings and walls or between rafters. It can also be utilized by telephone companies as a tone-test set. The instrument is called a "woodpecker telefault" and combines the features of the "telefaults" and "telepipes" made by the above concern. The device is equipped with a set of resistors of known resistances, ranging in value from 10 ohms to 500 ohms, by means of which the operator is able to determine approximately the point of trouble before going out and finding the exact location with the exploring coil and receiver. Only one dry cell is utilized with the instrument. The exploring coil is very sensitive, it is declared, and is contained in a case of bakelite. The exploring coil, receiver and battery are housed inside a box, which is 10.5 in. by 9.625 in. by 5.5 in. in size.

APPARATUS FOR LOCATING DEFECTS IN ENERGY-CARRYING CIRCUITS

Plate Adapter for All Fans

As the screw holes in the bases of some makes of fans are not in the proper position for attaching to the hanger cover made by the Frank Adam Electric Company, St. Louis, Mo., that company has developed the adapter plate shown in Fig. 1, which is provided with six holes so that nearly every make of fan can be attached to it in the proper position. The plate is of heavy steel and is japanned on both sides. In one corner is a 0.25-in. hole, where the plate is bolted to the hanger cover. The other corners are fitted with rubber plugs which project ⅛ in. on the under side, keeping the

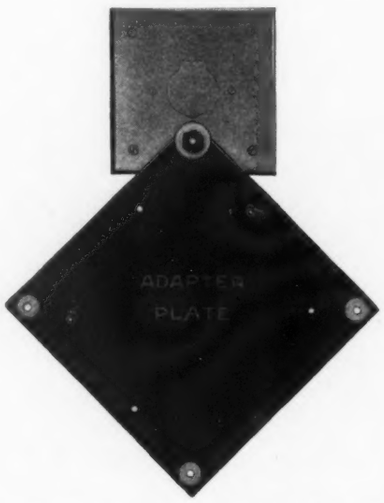


FIG. 1—PLATE ADAPTER TO WHICH FAN IS ATTACHED

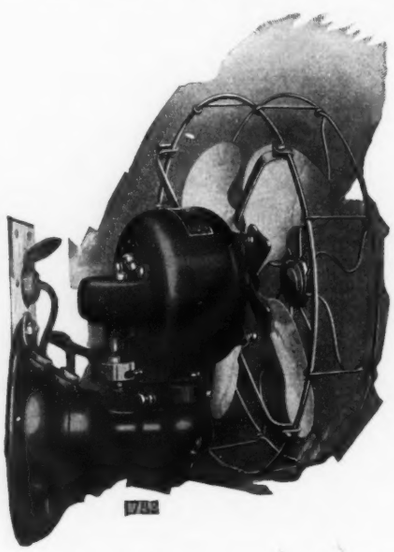
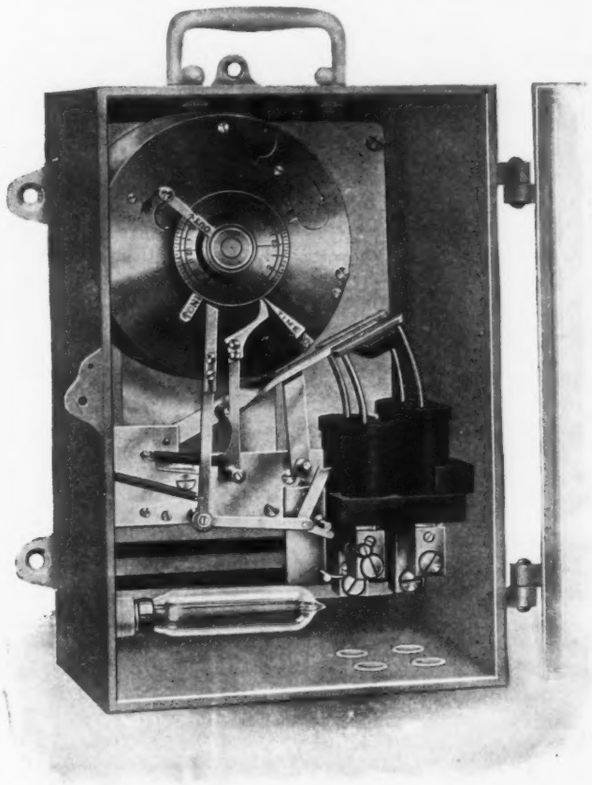


FIG. 2—FAN ATTACHED TO PLATE ADAPTER

plate in alignment with the hanger cover and holding it firmly in position on the wall. In case all the holes do not engage properly, it is a simple matter to drill a hole or two in the right place. In Fig. 2 is shown a fan attached to the plate, which is bolted to the hanger cover.

Time Switch

The time switch shown herewith is designed for use in the United States and has been approved by the Underwriters' Laboratories. Copper-to-copper contacts are made under mercury to provide larger contact surface. According to the manufacturers, the mercury cups are so formed that there can be no splashing or spilling of mercury. Use is made of a hand-wound forty-five-day or fourteen-day clock. The dial is marked off in quarter hours, and the hands can be set to any

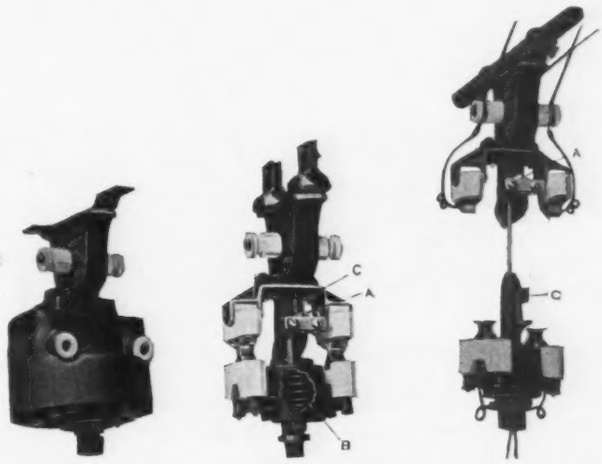


TIME SWITCH WITH DOOR OPENED

desired intermediate position. A test dial is provided to enable the timekeeping to be readily checked. The device has been developed by the Venner Time Switches, Ltd., 60 Queen Street, Westminster, S. W., England.

Cut-Out Hangers for Large Tungsten Lamps

The cut-out hangers shown herewith have been developed by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, for use with large tungsten lamps. The lamp is raised to the operating position by a slow pull, thereby compressing the stiff spring *B* in the base (Fig. 2) and forcing the contacts together; on releasing the rope slowly the latching pawl *A* falls into place. To lower the lamp the rope is given a slow, strong pull, and is then quickly released, causing the latch stem *C* to be let out before the latching pawl falls into place. According to the manufacturer, every part of the device subjected to strain is of malleable iron or phosphor bronze. In Fig. 1 is shown a hanger of the deep-canopy type which is designed for use outdoors. It is equipped with a cleat bail so that it can be bolted or clamped to a girder, bracket arm or



FIGS. 1, 2 AND 3—CUT-OUT HANGERS FOR OUTDOOR AND INDOOR USE

other rigid support. The hanger shown in Fig. 2 is designed for use indoors, and is equipped with cable clamps which afford a means of attaching the hanger to a span wire. A hanger for indoor use is shown in Fig. 3 unlatched, ready for lowering the lamp.

Reflectors for Display Window Lighting

The reflectors illustrated herewith have recently been developed by the Simplex Conduits, Ltd., Garrison Lane,

FIG. 1—ORNAMENTAL REFLECTOR

Birmingham, England, for display-window lighting. The device illustrated in Fig. 1 is ornamental in design and is for use where the reflector is visible. It is fitted with a slide clip to enable it to be attached to plate-glass shelves.

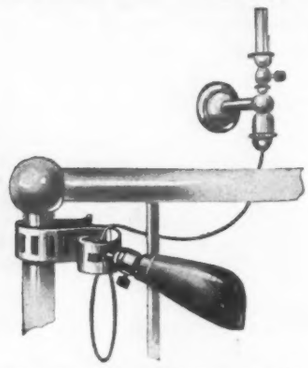
The reflector may be also utilized as a piano-lamp or desk-lamp reflector. It is 8 in. wide and is given a brass finish. The reflector shown in Fig. 2 is designed

FIG. 2—REFLECTOR OF SUSPENSION TYPE

for use in suspending near the top of the window. It is particularly adapted for use with deep windows. The inside is lined with a fluted mirror, which gives excellent light distribution. The opening measures 5.5 in. by 24 in.

Adjustable Fixture for Attaching Lamp to Bedpost

A fixture which is adjustable and which can be attached to a bedpost or similar object, as shown herewith, is being made by the Pittsburgh Lamp, Brass & Glass Company, Pittsburgh, Pa. The fixture, including shade, is finished in dull English brass and is equipped with a plug and 6 ft. of cord.



ADJUSTABLE LIGHTING FIXTURE

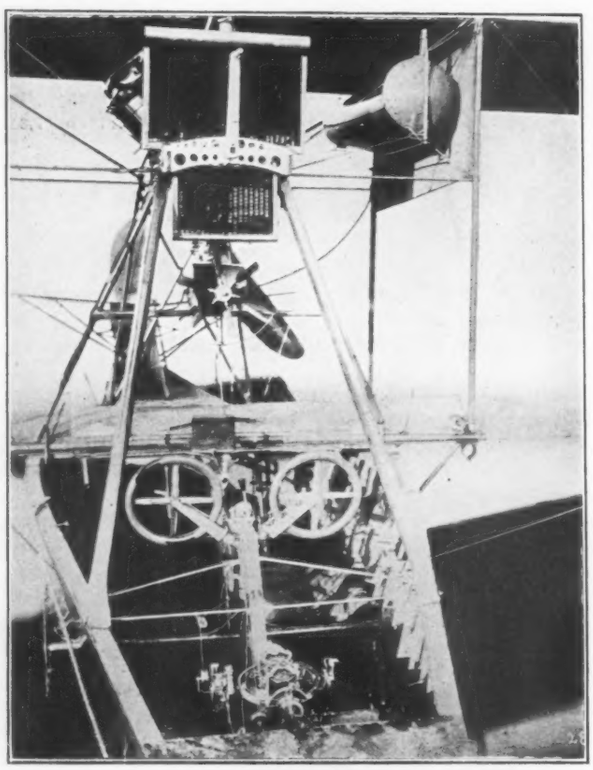
Polarized Motor Plug

The composition cap with knife-blade contacts employed with the plug illustrated herewith is designed to be permanently attached to electrically operated machines. To facilitate the use of the plugs in connection with portable machines, the base may be attached to a leader and connections made with various machines equipped with the polarized cap. The body of the portable base is of composition metal and the end is brass-covered. The plug has been placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn.

POLARIZED PLUG AND CAP

Electrically Operated Gyroscopic Aeroplane Stabilizer

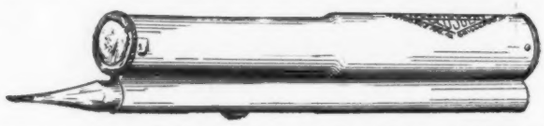
In the accompanying illustration is shown the interior of an aeroplane equipped with electrically operated stabilizing apparatus. A double generator is used which furnishes three-phase alternating current and 20-volt direct current. Four small gyroscopes are operated on alternating current while direct-current energy is utilized to operate the magnetic clutches and to charge a 9-in. "Exide" battery. The stabilizer is made by the Sperry Gyroscope Company, Long Island City, N. Y.



INTERIOR OF AEROPLANE EQUIPPED WITH ELECTRICALLY OPERATED STABILIZER

Pencil Flashlamp

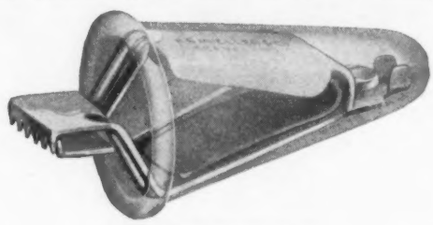
In the accompanying illustration is shown a handy device which by means of a small flashlamp enables one to use a pencil in the dark. The lamp circuit is closed by pushing the pencil out from the case by a thumb slide. The pencil may be removed or inserted at will, and the lamp can be operated with or without the pencil by the thumb slide in the pencil barrel. The device measures 5.25 in. long, 1 1/16 in. wide, and 0.75 in. deep. The length of the pencil is 5 in. The weight of the device complete is 3 oz. It is being made by the Hawthorne Manufacturing Company, 35 Spruce Street, Bridgeport, Conn.



TUBULAR FLASHLAMP WITH LEAD-PENCIL ATTACHMENT

Electric Test Clip

A test clip with a rating of 20 amp has just been developed by R. S. Mueller & Company, 423 High Avenue, S. E., Cleveland, Ohio. The clip has a wider opening of the jaws than the 15-amp and 100-amp clips made by the company, thus permitting its use with larger terminals, binding posts, etc. A screw connection for the cord is provided in place of a soldered connection. The screw connection is of special value, it is declared, to linemen and troublemen who use the clips in the field, because if the connecting cord is broken repairs can be readily made on the spot. The clip is of a non-

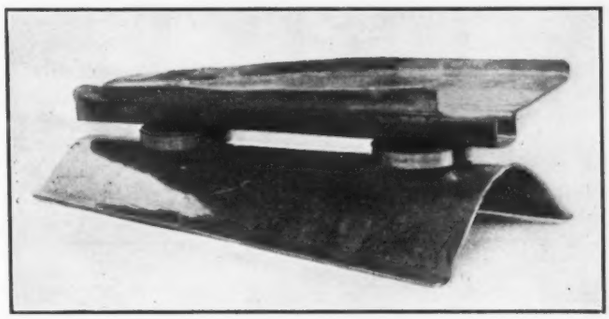


20-AMP TEST CLIP

corrosive material, the side members being of copper and the springs being enameled. The copper parts of the clip can be lead-plated, if desired, for protection against acid fumes when the clip is used in charging storage batteries.

Stand for Electric Iron

The electric-iron stand shown herewith consists of two pieces of formed, nickel-plated steel, which are riveted together but separated by two disks of asbestos, each of which is reinforced by a flanged-steel ring. The top piece of steel on which the iron rests is shaped like the bottom of a pressing iron and is bent up on two



STAND FOR IRONS

sides in the form of a flange. A channel extends the entire length of the stand through its middle for the circulation of air. The lower piece of steel is half cylindrical in shape, the forward end having a smaller radius than the rear end, thus giving it a forward inclination. The stand is being placed on the market by the Central Flatiron Manufacturing Company, Binghamton, N. Y.

Photographic Lighting Unit

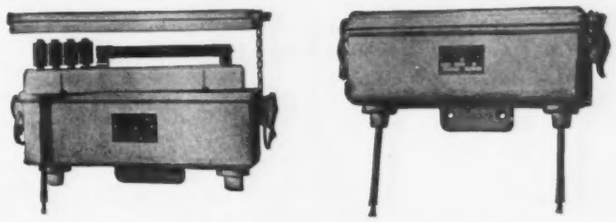
A fixture designed for use with nitrogen-filled lamps for photographic purposes, such as studio work, home portraiture, printing and enlarging, has been placed on the market by the Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill. Ample ventilation is provided, the manufacturer declares, and one unit furnishes sufficient illumination for taking pictures of groups of as many as twenty

FIXTURE FOR PHOTOGRAPHIC LIGHTING

people. The unit is portable and fits in a case 18 in. by 22 in. by 8 in. It can also be utilized to make any size of print up to 11 in. by 14 in. The fixture can be mounted on a tripod as shown in the accompanying illustration.

A 2500-Volt Lightning Arrester

A spark-gap and resistance arrester for alternating-current circuits of any frequency with pressures up to 2500 volts has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The arrester is a single-pole device and may be installed out of doors on poles or buildings, or indoors on station walls. It consists of a series of spark-gaps between non-arcing cylinders in series with a resistor.



FIGS. 1 AND 2—LIGHTNING ARRESTER, SHOWING PARTS AND ARRESTER ASSEMBLED

Four cylinders are employed for the spark points so that in case of burning one cylinder it can be turned in order to obtain a new arcing surface. The resistor is of composition material and is utilized to prevent the arcs that might be produced with circuits of large rating. The resistance is low enough, it is declared, to give good protection, but high enough to insure reliable operation and to enable the non-arcing metal gaps to quench the arc at the end of the first half-cycle.

Electric Hand Lamp

The electric lamp shown herewith is equipped with a bail and a hand grip so that it can be employed as either a lantern or a hand lamp as desired. The bail is removable. The diameter of the case is 3 in., the height 10 in., and the complete weight of the device with dry cell is 3 lb. The case is of steel and is finished in royal-blue enamel. Use is made of a seamless

HAND LAMP OPERATED BY DRY CELL

top hood of highly polished nickel plate. The reflector hood contains a 5-cp tungsten lamp. This hand lamp is being placed on the market by the Federal Sign System (Electric), Lake Street and Desplaines Street, Chicago, Ill.

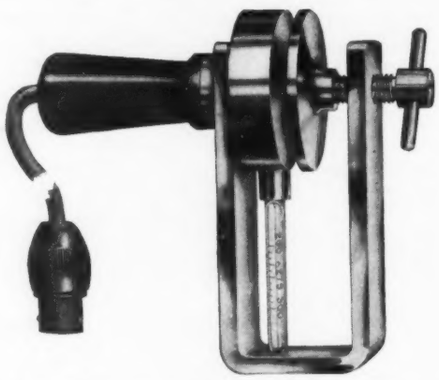
Semi-Indirect Lighting Unit

A simply constructed lighting unit of the semi-indirect type has just been put out by the Benjamin Electric Manufacturing Company, of 120 South Sangamon Street, Chicago. The construction of this unit, with its conventional canopy and brass chain, is shown herewith. The ventilating hood and 6-in. holder are made of brass and support a 16-in. opal glass reflecting dome. Suspended beneath the dome and the lamp is an opal glass bowl, 8 in. in diameter, which diffuses the direct light from the lamp. Porcelain sockets with either medium or mogul bases are furnished with the fixture.

SEMI-INDIRECT LIGHTING FIXTURE

Portable Electric Vulcanizer

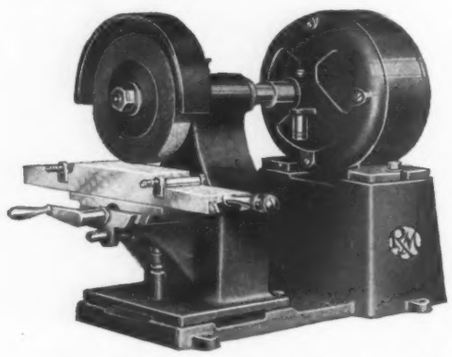
A vulcanizer which can be operated on a 6-volt automobile storage battery has been developed by the Corbett & De Coursey Company, Pittsburgh, Pa. The device is equipped with a flexible cord and a bayonet-type plug. It weighs complete with canvas bag 2 lb. and may be carried in the tool box of the automobile. A thermometer is used with the vulcanizer which is calibrated so that a temperature of 275 deg. Fahr., at which the vulcanizing operation is performed, can be maintained. With the vulcanizer described above, tires can be repaired on the road when this becomes necessary because of accident as well as in the garage.



ELECTRIC VULCANIZER FOR AUTOMOBILE TIRES

Motor-Driven Grinder for Preparing Test Samples of Rubber

The apparatus illustrated herewith has been developed for preparing samples of rubber of uniform cross-section for tests of tensile strength. It is designed especially for use in testing samples of hose lining. A section of hose several inches long is slitted along its length, and the interior lining with its rubber backing is stripped from the fabric. This strip of rubber is cut to a uniform width of 1 in. for a distance of 3 in. or 4 in. The strip is then strapped closely to the platen of the grinder, smooth side down, and is held firmly in position by the two eccentric rolls. By means of the longitudinal, vertical and cross adjustment of the platen of the grinder the sample can be ground down to a uniform thickness throughout the length of the test section. The grinder is directly driven by a 1/6-hp motor made by the Robbins & Myers Company, Springfield, Ohio.



GRINDER FOR PREPARING TEST PIECES OF RUBBER

Fixtures for Nitrogen-Filled Lamps

Fixtures for high-efficiency incandescent lamps are being made by the T. C. White Company, 1122 Pine Street, St. Louis, Mo. The top or socket housing of the device is separated from the fitter by heat-resisting bushings. According to the manufacturer, ample ventilation is provided for disposing of the heat at the neck of the lamp. For a 10-in. globe a 6-in. fitter and a small socket are employed, and for a 12-in. globe an 8-in. fitter and a large socket are utilized. The fixture shown herewith is designed for use with lamps varying in rating from 100 watts to 1000 watts. Fixtures are also being made with 16-in. and 18-in. flat reflectors for use with 12-in. globes. The fixtures are designed for indoor or outdoor use and are finished in porcelain enamel, brass or black japan.

FIXTURE FOR NITROGEN-FILLED LAMP UP TO 1000 WATTS

CURRENT NEWS SECTION

New Officers of the American Institute

At the annual meeting of the American Institute of Electrical Engineers, held at New York City, May 18, preceding the award of the Edison Medal to Dr. Alexander Graham Bell, inventor of the telephone, the report of the tellers' committee, read by Secretary F. L. Hutchinson, announced the election of officers as follows:

President, Mr. J. J. Carty, chief engineer American Telephone & Telegraph Company, New York; vice-presidents, Messrs. William McClellan, consulting engineer, New York; Comfort A. Adams, Harvard University, Cambridge, Mass., and J. F. Stevens, consulting engineer, Philadelphia; treasurer, Mr. G. A. Hamilton, Elizabeth, N. J.; managers, Messrs. C. E. Skinner, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.; John Taylor, General Electric Company, Schenectady, N. Y.; F. B. Jewett, Western Electric Company, New York, and Harold Pender, University of Pennsylvania, Philadelphia.

The report of the board of directors, presented at the meeting, showed that the Institute on April 30 had 8054 members, of whom 448 were fellows, 1079 were members and 6522 were associates. The Institute now has thirty-one sections and fifty-two branches.

Ohio Commercial Men at Columbus

The fifth bi-monthly convention of commercial men of the Ohio Electric Light Association, held at Columbus May 19, was welcomed to the city by Mr. S. G. McMeen, president of the Columbus Railway, Power & Light Company. Other addresses made and papers presented were as follows: "Value of Show-Window Advertising," by Mr. L. T. Milnor of Cincinnati; "Service First," By Mr. A. C. Seymour, president of the Columbus Chamber of Commerce; "Salesmanship," by Mr. Kenneth McKinley, efficiency engineer for the State of Ohio, and "Electrical Advertising," by Mr. V. L. Blanchard of the Toledo Railways & Light Company. The discussions at the sessions, following the trend of principal interest, diverged widely at times from the subject of the papers, but the subjects of window trimming, sign sales campaigns, and methods of increasing the energy consumption of small customers appeared to be the topics of chief interest to the delegates. Mr. Thomas F. Kelly, commercial manager of the Dayton Power & Light Company, was chairman of the meeting.

Hearings by Trade Commission on Export Combinations

The interest of business men in the work of the Federal Trade Commission this week centers in the public hearings announced to be held in Boston and New York on the general subject "Combinations of Exporters." These are to be preliminary to an investigation of foreign trade conditions as they affect the United States. After the date of these hearings was announced it was advanced so that now the hearings in Boston are to be on June 1 and 2 and those in New York on June 3, 4 and 5.

The Federal Trade Commission is trying to get in touch with leading exporters with a view to making a list of those who may be heard at these sessions, but so far not even tentative names have been given out.

All phases of combinations of exporters will be under consideration, including those for the maintenance of joint selling agencies, for co-operative advertising, etc.

Pan-American Delegates Welcomed in New York

At a Pan-American luncheon meeting of the members' council of the Merchants' Association of New York at the Hotel Astor on May 13, the delegates from Central and South America to the foreign trade financial congress which is to meet in Washington on May 24 were entertained.

Mr. Frank A. Vanderlip, president of the National City Bank of New York, was among those who made addresses welcoming the visitors. He said in part:

"If our national course in the trying circumstances in which we find ourselves placed reveals to you and to your peoples that our national ideals are in accordance with your national ideals; if our action is such that you are convinced that we are a nation without dangerous ambitions; if you find that as a people we see clear-eyed what is right and just and honorable in international relations and have calmly apprehended what our course should be, and then find that we have the firmness of purpose and the courage for sacrifice, if necessary, to demand effectively that, in return, any other nation with which we maintain relations shall follow a course that is also right and just and honorable, I believe you will then have had such a revelation of our national character that there will follow true and permanent national friendships. If this revelation of character is such as I believe it will be, it will give to you an understanding of our ideals and an appreciation of our moral fiber that will bring a unity of sentiment in these two continents more important to civilization than all the trade relationships that we may ever hope to build."

Mr. Samuel Hale Pearson, director of the Banco de la Nacion Argentina, made a response to the addresses on behalf of the visitors.

Plans for Pan-American Conference

The Pan-American financial conference called by Secretary of the Treasury McAdoo, which will be attended by at least fifty-seven delegates representing eighteen of the twenty Latin-American republics—Haiti and Mexico alone having no delegations—will meet in the Pan-American building, Washington, D. C., commencing on May 24. The opening address of welcome will be made by President Wilson.

Secretary McAdoo and Prof. L. S. Rowe, University of Pennsylvania, who has been appointed secretary-general of the conference, have devised methods to permit intimate and definite discussion of the problems of Latin-American countries. The conference will accomplish its practical work in round-table talks where the delegates will meet a select number of prominent bankers and business men and discuss and explain the

particular problems of their own particular country. There will also be general meetings to discuss these questions of common interest to all American republics:

1. Present financial needs in national, state and local governments; nature and character of public loans; how secured; rates of interest thereon; where such loans have been placed, and the price; possibility of placing such loans in the United States; effect of the European war on public revenues and expenditures; relations of decline of public revenues to guarantees of payment of interest and principal.

2. Normal and financial needs of public service companies; present needs; character and nature of bonds or obligations they offer; how secured, etc.; possible conditions of financing in the United States; effect of the European war on such companies.

3. Normal financial needs of commerce, such, for instance, as credit facilities; direct or dollar exchange; possibility of adapting commercial credits in the United States to the needs of Central and South America; effect of war on financing of foreign commerce.

4. Transportation between the United States and the countries concerned; improved postal service, money orders, parcel past, etc.

Loss of Mr. I. B. Trumbull and Policy of Trumbull Company

In connection with an announcement in last week's issue regarding those who were on the steamship *Lusitania*, which was sunk by a German submarine on May 7, the ELECTRICAL WORLD published a statement that the death of Mr. Isaac B. Trumbull, of Plainville, Conn., who was one of the passengers, had led his brothers in the Trumbull Electric Manufacturing Company to decide to embark on the manufacture of munitions of war. Regarding this report Mr. J. B. Trumbull, the president of the company, writes to the ELECTRICAL WORLD as follows:

"Our well-equipped plant is not running up to its full capacity at this time, and for this reason alone we decided to look into the question of manufacturing such parts of munitions of war as could be conveniently got out without interfering in any way with the efficient service we endeavor to maintain in handling the electrical lines. It was our sole object to utilize such idle machinery and labor as we could in making up material for export that prompted us to consider the matter, and this matter was under consideration some time before the sinking of the *Lusitania*.

"A local reporter picked up some information to the effect that we were considering the manufacture of war material and, connecting it with the death of our brother Isaac, placed this company in an embarrassing position by spreading the news broadcast, for we have been the recipient of numerous inquiries from all parts of the country.

"You will readily understand from these actual facts that we have been misrepresented in this respect, and we are anxious to have the statement corrected so that it may become known that our policy remains unchanged. Should anything further develop along this line, we would consider it from a commercial standpoint only, and no feeling of sentiment would enter into our business transactions.

"While we feel that the sinking of the *Lusitania* was downright murder on a wholesale plan, still we do not consider it a basis sufficiently strong to warrant jeopardizing the lives of the citizens of the United States by entering into war with foreign countries, and I thoroughly realize that this is the time when we have to look to the executives of our national government to give the matter serious thought, weighing well the loss and gain of a nation rather than that of any one individual.

"This is the policy which we have endeavored to carry out through our own business, and while we cannot help entertaining the feeling of resentment which exists at the present time, still we have not for a moment permitted this feeling to have any bearing on our business policies or our desire to see fair play at every stage of the game."

Electrical Exports in March

Electrical exports in March, 1915, are reported by the Bureau of Foreign and Domestic Commerce as follows:

	March		Eight Months Ended March	
	1915	1914	1915	1914
Batteries	$166,041	$47,304	$685,206	$504,807
Dynamos or generators	236,305	376,985	1,610,442	1,980,676
Fans	20,533	54,718	119,439	343,108
Insulated wire and cables	236,849	154,696	1,002,230	1,739,489
Interior wiring supplies, etc., including fixtures	65,159	50,182	483,231	553,841
Lamps:				
Arc	2,409	2,686	27,404	68,997
Incandescent:				
Carbon filament	8,133	14,697	55,233	158,337
Metal filament	42,963	14,188	315,445	170,868
Meters and other measuring instruments	41,305	.....	262,054	
Motors	166,648	292,991	2,131,004	3,555,955
Static transformers	27,562	92,903	482,960	1,237,240
Telegraph instruments (including wireless apparatus)	7,335	6,062	58,404	95,907
Telephones	53,066	59,295	958,199	1,207,194
All other	587,363	937,625	5,675,841	8,211,717
Total electrical exports	$1,661,671	$2,104,332	$13,867,092	$19,828,136

Brown & Sharpe Contract for Central-Station Service

One of the most important contracts for central-station service ever concluded in New England has just been signed by the Brown & Sharpe Manufacturing Company of Providence, R. I., with the Narragansett Electric Lighting Company. This manufacturer of precision tools, milling machines and apparatus of mechanical interest has previously generated electrical energy for lighting and power in its works in a high-grade private plant, and the motor installation is one of the most carefully planned in the country. In January the Narragansett company began work upon the problem of introducing central-station service. A thorough engineering investigation and report led to the contract, which involves about 4000 hp in connected load. The Narragansett company will install two 11,000-volt, three-phase underground cable lines from its waterside generating plant in Providence to an outdoor substation on the factory premises, about a mile distant. Either line will carry the load satisfactorily. It is expected that six 400-kw transformers will be required, and that these will be mounted on a concrete platform with convenient switching and metering arrangements. The local motor service is largely three-phase at 250-volt pressure, the factory lighting being by direct current at 110 volts. The Brown & Sharpe company also requires direct current for magnetic chuck service and for variable-speed motor operation in machine-tool drives. This service will be handled by motor-generator sets installed at the factory. About 300 motors varying in size from fractional outputs to 50 hp are in use. Service will be begun in about twelve weeks. The Brown & Sharpe company will handle the heating service of the factory from the present steam plant. An electric truck service is a feature of the load.

Two Commissions Appraise Washington Water Power Company

Valuation of the property of the Washington Water Power Company of Spokane, Wash., which was begun recently by officials of the commissions of Washington and Idaho, is expected to take about two months. The work of collecting the necessary data is estimated to cost $8,000. It is expected that the commissions will establish a valuation on which rates for all service will be based. Idaho, though joining in the work, will pay only about one-fifth of the cost, because the electric railways, the larger electric-generating plants and the more extensive distribution systems are in Washington. Because of the fact that the company operates in two states some unusual difficulties are presented.

Progress of Electrification of Milwaukee Road

At a meeting of the Chicago Section of the American Society of Mechanical Engineers, May 14, Mr. A. F. Batchelder, chief engineer of the locomotive department of the General Electric Company, Mr. A. H. Armstrong, assistant engineer of the railway and traction department of the same company, and Dr. W. F. M. Goss, chief engineer for the committee investigating smoke abatement and electrification of Chicago railway terminals, were the principal speakers in an informal discussion of American steam-railway electrification.

Regarding progress on the Chicago, Milwaukee & St. Paul Railroad electrification, Mr. Armstrong stated that the overhead-line construction on the first engine division between Three Forks and Deer Lodge, a distance of 113 miles, is completed and that the overhead work on the second engine division is already well under way. He added that twin trolley wires suspended from staggered hangers would be used on this road to aid in eliminating arcing at the hangers.

Convention of Fire Protection Association

Several important committee reports were presented on the closing day of the nineteenth annual convention of the National Fire Protection Association, held at the Hotel Astor, New York City, May 11, 12 and 13, the opening sessions of which were reported in these columns last week. The committee reports were followed by an interesting round-table discussion on the subject of private fire-protection water connections to public mains, with special reference to automatic sprinkler connections to high-pressure systems.

The report of the committee on fire pumps, presented by Mr. H. O. Lacount, Boston, chairman, which was accepted, contains eight pages of requirements for the electrical operation and control of fire pumps. These requirements cover power stations, transmission lines, transformers, motors, and controlling and operating equipment. The requirements are such as to render the electrical equipment for fire pumps reliable, simple, strong, durable and easy of operation. One rule states that circuit-breakers protecting motors driving fire pumps should be set at 400 per cent of normal motor current, and that time-element relays must be provided with squirrel-cage induction-motor drive.

The report of the committee on manufacturing risks and special hazards was made by Mr. Benjamin Richards, Boston, chairman, and was confined to the subject of cold-storage warehouses. In the case of fur storage it was recommended that electric wiring in the cold-storage rooms be so arranged that each section would be controlled from outside the storeroom, the control being installed in the main tower or passageway so that all wiring inside the storage rooms will be disconnected when not in use. Portable lamps are not to be connected inside rooms used for fur storage. Portable lamps with wire guards and approved reinforced cord may be used if connected and kept outside the doors of the cold-storage rooms.

Election of Officers

The following officers were elected: President, Mr. Charles E. Meek, New York City; first vice-president, Mr. Louis Wiederhold, Jr., Philadelphia; second vice-president, Mr. D. Everett Waid, New York City; secretary-treasurer, Mr. Franklin H. Wentworth, Boston (re-elected).

Mr. F. J. T. Stewart, New York City, was re-elected chairman of the executive committee, and the following were appointed members of the committee for a term of three years: Messrs. H. W. Forster, Philadelphia; E. B. Hatch, Chicago; H. O. Lacount, Boston; A. M. Schoen, Atlanta, and Mason R. Strong, New York.

Hearing on Proposed Municipal Electrical Inspection and Code for New York City

A hearing on a proposed ordinance outlining a municipal electrical code and requiring property owners in New York City to obtain city permits and to pay the city for inspection of electric wiring was held at the City Hall, New York City, May 14. Considerable objection to the proposed ordinance was evident on the part of representatives of electrical, railway, real-estate, insurance and other interests present. Under existing conditions in New York City, inspections are made by representatives of the Fire Underwriters, who charge for this service, and the city and the electricity-supply companies accept certificates.

Another conference of parties interested in and affected by the proposed ordinance has been called by Commissioner Williams of the Department of Water Supply, Gas and Electricity for May 24.

The proposed New York City electrical code follows closely the rules laid down in the 1913 edition of the National Electrical Code, and as far as possible the numbering of rules has been kept identical with those of the National code. The proposed code differs, however, from the National code in a number of respects.

Wooden molding and concealed knob-and-tube work are forbidden for interior wiring. Additional rules are offered for the placing of wires of different systems on the same poles, the revisions being on the side of increased safety and more definite specifications. Subservices are permitted with both overhead and underground construction, but the number of premises to be supplied from one service cable is limited to five, except in case of special permission.

The proposed rules for theater wiring differ materially from those of the National Electrical Code. One proposed requirement is that all stage switchboards must be of the dead-front type. The leads to an arc lamp used as a part of the motion-picture machine and its rheostat or equivalent device must be protected by a plug cut-out or open-link fuses, the latter to be inclosed in an improved conduit with self-closing door. Cartridge fuses for motion-picture machine work, which are permissible according to the rules of the National Electrical Code, would not be allowed by the proposed New York code. With respect to miniature motion-picture machines for home and lecture use the proposed code is more drastic than the National Electrical Code.

Extensive rules are also laid down for garages, subways and other classes of installation not covered by the National code.

ELECTRIC ASSOCIATION OF OKLAHOMA

Public Relations, Commission Regulations, Customers' Deposits and Plant Fuels Topics of Discussion

Nearly 150 delegates attended the fourth annual convention of the Gas, Electric & Street Railway Association of Oklahoma, held at the Lee-Huckins Hotel, Oklahoma City, May 12 and 13. Mayor Edward Overholser welcomed the delegates at the opening session, and was followed by President George W. Knox, general manager of the Oklahoma Railway Company, who delivered his official address.

In this Mr. Knox analyzed the living expenses of the average family and showed that the lowest average expenditures are made for the items of light, heat and car fare. Still, it is upon the industries which furnish these that almost the whole cost of regulation is placed. Furthermore, while the prices of other things have risen, the cost of light, heat and car fare have all decreased.

The Public Is Reasonable in Its Demands

Most of the troubles of the utility corporations, declared Mr. Knox, could have been averted by a unified, honestly conducted campaign of public education by the companies, throwing open all records and giving unrestrictedly all information asked by the public. "In my twenty-five years' experience in handling public properties," he continued, "I have yet to find a single instance where the utility companies have not been given fair consideration by the public and its servants after the true situation had been explained and understood.

"If, with the rates you have and the amount of business being done, you are not coming out on the right side of the ledger and making fair returns, take the public into your confidence," advised Mr. Knox. "Show it how and why you are not making ends meet. Although it may be a little difficult to demonstrate to it that you should have an increase in your rates, you will get it. The public is amenable in such matters."

Mr. A. L. Mullergren followed with a paper on "The Modern Generating Station," and Messrs. E. H. Hunter and L. G. Purtee read papers on "The Comparative Fuel Values of Oil, Gas and Coal." Abstracts of these, with the resulting discussions, will be presented in a later issue.

Sale of Supplies by Central Stations

The first paper of the afternoon session was read by Mr. Galen Crow, Guthrie, on "The Purchase, Care and Sale of Supplies and Energy-Consuming Devices by Public Utility Companies," and occasioned a very lively discussion on the subject of the relation of the utility to the local contractor. The difference was pointed out between large and small communities, in the latter of which it is often impossible for a good or capable contractor to support himself. There are not more than three or four cities in Oklahoma which will support a responsible electrical contractor and dealer continuously. The question of the cut prices made by department stores and hardware stores was taken up, and the difficulty of control of that side of the industry was made evident.

Mr. M. J. Wolf, St. Louis, Mo., took the lead against the arguments urged by Mr. Crow, and endeavored to show the close relation between utility company, contractor, jobber and manufacturer.

A compilation of valuable data was presented to the convention by Messrs. R. W. Stinson and H. Livergood in their analysis of electric-service rates in Oklahoma.

Relations Between Company and Customer

At the Friday morning session the first paper was by Mr. N. R. Gascho, manager of the Alva Light & Power Company, and the first president of the association. Mr. Gascho's subject was "Public Utilities, Their Customers and the Public." Mr. Gascho enjoys extremely happy relations with his consumers. A large part of the discussion was devoted to the meter-deposit system, the guarantee deposit system, and the personal guarantee system, as related to the no-charge or credit system to insure collection of bills. Mr. Crow, of the Public Service Company, in charge of the Guthrie plant, declared that a public service company is as much entitled to a credit department as is a business institution, and that the deposit or guarantee or its absence should be at the discretion of a credit man.

The different customs of the companies with respect to meter testing were also brought out. Some companies do testing upon the basis that the consumer pays for the test if he is in the wrong. Mr. Gascho opposed this idea, because he said it only tends to breed discontent and does more damage than the dollar collected could possibly repay.

Utility Appraisals and Physical Equipment

The closing paper of the convention was on "Utility Appraisals Under Order No. 774 of the Corporation Commission of Oklahoma," presented by Mr. George B. Saunders, Oklahoma City. Mr. Harold Bozell, consulting engineer, who has been doing appraisal work under this and similar orders, led the discussion and brought up the point that the commission does not call for a full appraisal bringing the plant to "present value," as claimed by Mr. Saunders, but that the meaning of the commission is that the report should be only the "original cost," which includes the real overhead charges such as engineering, franchise cost, organization, legal, accident or liability insurance, taxes, interest and miscellaneous general expenses. The commission has not asked for the intangibles, and there is no place for them in the accounts provided for the commission. The commission, however, does not expect to omit these items in a valuation for rate purposes, but they are matters of doubt, whereas the original cost is theoretically a matter of record. It is for a complete list and cost sheet of all property now in use for the public service that the commission asks. In event of a rate case involving any property, there would have to be settled the questions of depreciation, working capital, bond discount, going-concern value, etc. Mr. Mussen, engineer for the commission, confirmed the interpretation by Mr. Bozell. He stated, however, that it was perfectly proper for an owner to make claim, in an attached exhibit, for the inclusion of such intangibles as he considered belonged to the property, in the event of a rate case coming up later, adding that the percentages might be added which it was thought should be added in such a case. The position of the commission is that it feels that the history of the plant has considerable weight in its present value for rate purposes, and that this is the reason the commission is calling for this original-cost report and asking for the actual figures expended whenever they can be produced. In general, the paper was conceded to present a good analysis of the difficulties of valuation, although it emphasized some points not included under Order No. 774.

Election of Officers

The following officers were elected: President, Mr. W. J. Dibbens, Guthrie; first vice-president, Mr. Hugh J. Cooper, Weatherford; second vice-president, Mr. C. H. Kretz, Okmulgee; directors, Mr. C. S. Dawley, Okmulgee; Mr. Lincoln Beerbower, Enid; Mr. Fred W. Insull, Oklahoma City, and Mr. J. J. Johnson, Oklahoma City; secretary-treasurer, Mr. H. V. Bozell, Norman, Okla.

Miscellaneous News Notes

Detroit Adopts Eastern Time.—Detroit has adopted Eastern standard time, the change having gone into effect on May 16. Under the new "daylight-saving" schedule, local factories and retail stores will open an hour earlier in the morning and close an hour earlier in the afternoon.

Pacific Coast Hearings on Bureau of Standards Safety Code.—Dr. E. B. Rosa and Mr. W. J. Canada, of the Bureau of Standards, recently held a two days' hearing and spent part of a day inspecting outside and inside plant conditions at Los Angeles, Cal., in connection with the bureau's contemplated safety code. Further hearings on the Pacific Coast are to be held at San Francisco, Portland and Seattle.

Electric Pumping Results in Increased Profit for Oil Company.—The directors of the Kern River Oilfields of California, Ltd., in their last annual report state that the increased profit earned by the company was obtained by the more extensive use of electric pumping and by rigid economy in other respects. According to latest reports, the company was pumping 230 wells electrically, and eleven by steam.

Wireless Station as Courtroom.—Judge Van Vechten Veeder ordered that his court convene at the Sayville (Long Island) wireless-telegraph station on May 20, in order to obtain further direct knowledge of the differences between the Marconi and Telefunken systems of radiotelegraphy disputed in the suit brought against the Atlantic Communication Company by the Marconi Wireless Telegraph Company. Previous hearings, as noted in these columns, have been held in the United States District Court in Brooklyn.

St. Louis' New Charter Contains Radical Clause.—The newly elected Board of Aldermen of St. Louis, Mo., according to a clause in the city's new charter, "shall have the power to condemn private property, real or personal, or any easement of use therein, for public use within or without the city or State, or to acquire, construct, own, operate and maintain or sell, lease, mortgage, pledge or otherwise dispose of public utilities or any estate or interest therein, or any other utility of service to the city, its inhabitants, or any part thereof."

Electric Light the Best Policeman.—To stop the nightly depredations of persons who had formed the habit of carrying off the inmates of his hencoops, a farmer near Chicago installed in his barnyard six 1000-watt nitrogen-filled lamps equipped with reflectors and controlled from a switch in his bedroom. When the customary commotion took place, the owner closed the switch lighting the lamps and "took a pot shot" at the intruders with a shotgun. Since their first experience, the trespassers are declared to have let that electrically protected chicken coop severely alone.

Plan to Reduce Number of Poles by Joint Use.—Mr. Clayton W. Pike, chief of the Philadelphia Electrical Bureau, hopes to reduce the number of poles in the city by encouraging their use jointly by local utility companies. There are at present approximately 87,000 poles in the city, the annual increase being about 2000. At a conference with representatives of the Philadelphia utility companies a committee consisting of Messrs. A. H. Manwaring of the Philadelphia Electric Company, J. E. Stockwell of the Keystone Telephone Company and J. P. Hayward of the Bell Telephone Company was appointed to consider the problem and to suggest means for carrying out the project.

Restrictive Electric-Sign Ordinance Vetoed at Columbus.—The ordinance recently passed by the Columbus (Ohio) City Council restricting the installation of electric signs has been vetoed by the Mayor, following appeals by local merchants. The ordinance thus nullified limited signs from projecting more than 12 in. beyond the building line, but a new compromise act now agreed upon will permit the erection of overhanging electric signs having at least two 4-cp bulbs per square foot of surface. Where such signs are 9 ft. to 29 ft. above the street, they may extend 5 ft. 6 in. beyond the building line. Above 29 ft. they may extend 9 ft. beyond the building line, or if hinged so as to be swung in during the daytime, 14 ft. beyond the line. When erected on roofs not less than 39 ft. above the street signs are permitted to extend 14 ft. beyond the building line.

Utah to Intervene in Water-Right Suit.—It is reported that the State of Utah will intervene in the cases of the United States versus the Beaver River Power Company and the United States versus the Beaver River Power Company and L. L. Munn. A decree in favor of the federal government has been entered in the federal District Court and the cases are now to go before the Supreme Court of the United States on a direct appeal. The State authorities will take the stand that the water-power rights involved are beneficial to the citizens of Utah and that the State and not the federal government should have power to control it. Should the holdings of the lower court be sustained, the State declares that its rights and those of its citizens will be jeopardized. It is further asserted that the use of water on government land in Utah will interfere with future developments and the acquiring of capital to develop the State's resources.

Welfare Work of the Detroit Edison Company.—In an address before 350 University of Michigan graduates at the Hotel Statler, Detroit, Mich., on May 12, Mr. Alex Dow, president of the Edison Illuminating Company of Detroit, told of the company's welfare work for its employees, enumerating the recreation field, the boat club on the river, the rest homes in the vicinity of Ann Arbor where sick employees may recuperate on full pay, the educational classes, the loan fund to keep employees from the grasp of "loan sharks," and the compensation schedule, which he said recompenses the heirs of an employee killed on duty to a greater extent than the Michigan State law requires. "The average rate of our wages has increased 13 per cent in the last few years," said Mr. Dow. "We had to do something to at least try to keep up with the increased cost of living." Speaking of old-age pensions, Mr. Dow mentioned the company's system based on a 3 or 4 per cent contribution from the salaries of employees, added to the fund set aside by the company.

Library Service Bureau.—The United Engineering Library (Engineering Societies Building, New York City) is installing a Library Bureau Service similar to the former Library Service Bureau of the Chemists' Club. For the purpose of inaugurating this service, the three founder societies of the mining, mechanical and electrical engineers will provide the necessary funds, but the bureau is expected to become self-supporting. The object of the bureau will be to place the facilities of the United Engineering Library at the disposal of anybody anywhere. Its work will consist in supplying reference cards on articles published anywhere on any special technical subject desired, in supplying copies of articles or of parts of books, translating articles from foreign languages, making searches on any technical subject, etc. This work will be done at cost. Mr. E. Gybbon Spilsbury is the chairman of the library service committee, which will act in advisory co-operation with the executive committee of the library board of the United Engineering Society, of which Dr. Samuel Sheldon is the chairman.

Licensing Ordinance Creates Deadlock at Evansville, Ind.—Electrical contractors of Evansville, Ind., are at present handicapped by an unusual condition which has resulted from the enactment of a city ordinance requiring all electrical workers to pass examinations as to their competency to do electrical work. The ordinance is in dispute, and a hearing on a suit to test its validity is set for June 9. In the meantime the city officials are declining to inspect work or to permit turning on service for work not inspected where the work has been performed by wiremen not qualified by examination, while, on the other hand, the electrical workers' union has instructed its members not to take the examinations under penalty of a ten-dollar fine, besides ordering those who have done so off their jobs. This is, of course, the contractors' busy season, and all the Evansville contractors are short-handed. Few have been successful in getting wiremen from other cities who are capable of passing the examinations. No arrests have been made by the city authorities for violation of the measure, since it is believed that the courts would hardly pass on such cases while the law under which the arrests were made remains in doubt. The contractors favor the measure, but want some means provided by which they can get their work done. The motion-picture operators have indorsed the ordinance and have all passed their examinations.

Associations and Societies

Faraday Club of Worcester, Mass.—The Faraday Club, an organization of the employees of the Worcester (Mass.) Electric Light Company, at its annual meeting on May 11 elected Mr. Harry D. Learnard president, Mr. A. B. Sprague secretary, and Mr. F. L. Vaughn treasurer.

Isolated Plant Service Discussed.—During the annual convention of the National Association of Hosiery and Underwear Manufacturers, held in Philadelphia in the first week of May, an address was delivered by Mr. C. M. Ripley, a consulting electrical engineer of New York, on isolated plant service.

New York Section, E. V. A.—"Electric Vehicle Charging Apparatus" will be discussed by representatives of manufacturers of charging equipment at a meeting of the New York Section of the Electric Vehicle Association of America to be held in the Consolidated Gas Company Building, 130 East Fifteenth Street, May 25, at 8:15 p.m.

National Gas Engine Association.—The annual convention of the National Gas Engine Association will be held at the Hotel La Salle, Chicago, June 23 and 24. Among the papers to be presented is one by Mr. Charles H. Roth, Chicago, on farm lighting plants. Mr. H. R. Brate, Lakemont, N. Y., is secretary of the association.

Officers of Chicago Section, A. S. M. E.—By unanimous vote of the members, officers for the Chicago Section of the American Society of Mechanical Engineers were elected for 1915 as follows: Chairman, Mr. H. M. Montgomery; vice-chairman, Mr. Joseph Harrington, and secretary, Mr. R. E. Thayer. Mr. S. G. Neiler is retiring chairman of the section.

New York Electrical Society.—At an informal smoker held by the New York Electrical Society, May 19, Messrs. J. M. Wakeman and H. W. Alexander of the Society for Electrical Development told of the latter society's work and its plans for "Electrical Prosperity Week." The evening was concluded with a presentation of the society's motion-picture film, "This Is the Life."

New York Jovian League.—At the luncheon of the New York Jovian Electrical League at the Hotel Martinique on May 19, Mr. George Weiderman, of the George Weiderman Electric Company, Inc., was chairman of the day. Mr. A. C. Kingman, of the Western Electric Company, gave a talk, illustrated with stereopticon slides, on the Pacific Coast expositions at San Francisco and San Diego. Mr. J. S. Rickard talked on the Jovian Order,

Chicago Electric Club Hears Mayor Thompson.—Mr. William Hale Thompson, the newly elected Mayor of Chicago, was the speaker at the meeting of the Electric Club of Chicago, May 13. A resolution highly commending the work of Mr. Ray Palmer, commissioner of electricity, in reconstructing the city's street-lighting system was passed by the club. The Electric Club also unanimously voted to change its name to "The Electric Club—Jovian League" as the first step toward a consolidation with the Chicago Jovian League.

"Button Fines" Fill Jovian Treasury at Louisville.—A system of fines has been inaugurated at the weekly luncheon meetings of the Louisville Jovians, which is expected to contribute to the growth of the local league's treasury. Each member has been furnished with a big red button bearing his name and that of his company, in order to expedite introductions. Each man who attends is asked to wear his button at all luncheons. If he fails, he is fined 10 cents, which goes into the treasury. Louisville Jovians will hold a moonlight river excursion on the steamer *Corona* on the evening of May 25.

I. E. S. Popular Lectures.—At a meeting of the council of the Illuminating Engineering Society held on May 13, Prof. C. E. Clewell, chairman of the committee on popular lectures, stated that the committee has in preparation five popular lectures on industrial, store, office and residence lighting, and on the fundamentals of light and illumination. It is intended that these lectures shall present in simple and attractive form the elementary principles involved. Copies of each lecture, together with suitable lantern slides, will be rendered available for loan to those who desire to deliver popular lectures on lighting. The manuscripts have been prepared for the lectures on store and residence lighting, and these will shortly be submitted for approval by the council.

Association of Municipal Electricians.—The International Association of Municipal Electricians will hold its 1915 convention at Cincinnati, Ohio, Aug. 24, 25 and 26, with headquarters at the Hotel Gibson. Mr. Clarence R. George, Houston, Tex., is secretary.

Philadelphia Meter Division Meeting.—More than 200 attended the annual banquet of the electric meter division of the Philadelphia Section of the National Electric Light Association on May 6, at the Hotel Adelphia. Mr. William C. L. Elgin, vice-president of the Philadelphia Electric Company, acted as toastmaster. The following made short addresses: Messrs. Joseph B. McCall and Walter H. Johnson, president and vice-president respectively of the Philadelphia Electric Company; Washington Devereux, chief of the Fire Underwriters' Association, and Clarence A. Stimpson.

Electric Club of Cincinnati.—The Electric Club of Cincinnati, composed of officers and executives of electrical concerns in the city, has been formally organized, with officers as follows: President, Mr. Thomas J. Ryan; first vice-president, Mr. L. T. Milnor; second vice-president, Mr. A. M. Wilson; secretary-treasurer, Mr. A. L. Reichmann, and executive committee, Messrs. W. W. Freeman, Walter Draper and J. A. Brett. A dinner preceded the organization meeting, at which Mr. J. W. Schrantz, head of the local branch of the Jovian Order, presided as toastmaster. The club has fifty members and will hold monthly meetings.

Ohio Electrical Contractors' Association.—The annual convention of the Ohio Electrical Contractors' Association, held at the Havlin Hotel, Cincinnati, May 12 and 13, was attended by about twenty-five members of the organization, although Cincinnati and outside jobbing representatives increased the number present to forty or more. With President Charles Aull, of Cincinnati, presiding, the first day of the convention was devoted exclusively to business and the discussion of trade topics. The second day was given over to entertainment in charge of a committee headed by Mr. A. C. Beattie, of the Beattie Electrical Company. After an automobile tour of the city, the guests were taken to the quarters of the Ohio River Launch Club for dinner. After this the party boarded the launch *Margaret*, owned by Mr. W. H. Hubbell, of the Cincinnati Fire Prevention Bureau, for a trip to Fernbank Dam. The officers elected by the association were: President, Mr. W. H. Bothwell, Youngstown, succeeding Mr. Charles Aull; vice-president, Mr. W. H. Harrington, Cleveland, succeeding Mr. Charles Hall, Dayton; secretary, Mr. Buchan, Cleveland, succeeding Mr. Frank Grant, Cleveland, and treasurer, Mr. W. G. Reuter (re-elected).

Missouri Public Utilities Association.—At the convention of the Missouri Public Utilities Association to be held May 27 to 30 on board the steamer *Quincy* during a cruise on the Mississippi, Ohio, Cumberland and Tennessee Rivers the following papers of interest to electrical men will be presented: "The Duty of the Modern Public Utility Toward the Public It Serves," by Mr. H. C. Porter of St. Joseph, Mo.; "The Ideal Lighting and Power Installation for a Small City," by Mr. J. D. Bowles of Jefferson City; "Financing and Valuation of Public Utilities," by Mr. C. F. Enright of St. Joseph; "Power House Economies," by Mr. E. J. Billings of St. Joseph; "The Relation Between the Missouri Association and the Public Utilities Commission," by Mr. J. H. Van Brunt of St. Joseph, and "Appraisal and Rate Regulation," by Mr. R. E. McDonnell of Kansas City, Mo. In addition to the written papers a free and thorough discussion of "Customers' Complaints" has been planned. Topics to be covered in this discussion are: The attitude of employees toward the public; separation of application and complaint departments where the business is heavy enough to support the dual office; instilling as the motto of the application and complaint departments, "Get acquainted with the consumer"; course toward a consumer who, owing the company money, applies for service while delinquent; improvement of service from complaints and questions received at the complaint desk; returning consumers' deposits after they have established their credit with the utility; handling securities for deposits; the policy of allowing utilities to charge bad debts to operation expense; preventing wrong readings of meters; grounded electric circuits as cause for adjustment; basis of adjustment if a meter is found creeping; prepayment meters as a cause or a remedy for complaints; handling the matter of cash discount on bills in dispute, etc.

Public Service Commission News

Colorado Commission

The Colorado Electric Light, Power & Railway Association has issued a statement as a result of the failure to secure an amendment to the public utilities law providing that certificates of public convenience and necessity must be secured from the Public Utilities Commission before plants are constructed. The association refers to the action taken by so-called "raiders" who have secured sometimes competitive franchises, although the result is that in the end the competitive plant is acquired and merged with the existing utility. The result of such a raid is to give a community sometimes an ephemeral lowering of rates, followed, upon the cessation of hostilities, by the restoration of something more than the old rate scale, but such restoration frequently does not result in sufficient increase in earnings to wipe out entirely the losses of the fight, and therefore investors suffer.

Missouri Commission

A summary of the recent valuation of the property of the Kansas City Electric Light Company has been made, as follows:

The work of the commission, in determining the value of the property of the Kansas City (Mo.) Electric Light Company, was in two parts, as was the report of the company made in February, 1914. An appraisal was made by the engineers of the commission, independent of any of the company's records, as to the cost to reproduce the property, on the basis of both cost new and depreciated value. The values on these two bases, determined by the engineers of the commission, were: Cost new, $7,054,499; present value, $5,713,882. These two values represent not only the property of the Kansas City Electric Light Company, but also that of its subsidiaries—the Kansas City Heating Company, Standard Electric Light Company and Electric Truck Company. The values are as of Nov. 30, 1914.

SUMMARY OF VALUATION	Cost New	Present Value
Commission accountants:		
Kansas City Electric Light Company	$5,306,144	$3,995,722
Kansas City Heating Company	*838,553	†800,919
Standard Electric Light Company	*273,000	†240,000
Stores and cash	†536,906	†536,906
	$6,954,603	$5,573,547
Additions—February to November inclusive	302,000	140,000
	$7,256,603	$5,713,547
Engineers' values	7,054,499	5,713,682
Company's value:		
From books, eliminating bond discount	7,149,475	5,676,988
Appraised value, eliminating bond discount	7,023,064	5,966,395

*From company's records.
†From engineers' report—not given by accountant.

The value returned by the company as of Feb. 1, 1914, was: Cost new, $7,265,272; present value, $6,129,605. New property was added to the plant account between the date of the company's report (Feb. 1, 1914) and that of the commission's report (Nov. 30, 1914), representing a cost new or present value of $225,000. Thus the company's appraised value, as of Nov. 30, 1914, would be $7,490,272 cost new, or $6,354,605 present value.

The commission did not consider bond discount as a capital charge item. The company's report included as the cost of bond discount $467,208 for cost new and $388,210 for present value. Deducting bond discount, the company's reported totals were: Cost new, $7,023,064; present value, $5,966,395. Therefore, eliminating the item of bond discount, the commission's estimate of the "cost to reproduce new" is approximately $30,000 in excess of that claimed by the company, and the present value of the property is approximately $250,000 less than that claimed by the company. The decreased depreciated value is due to the fact that ten months' additional depreciation was taken into account in the commission's figures, while depreciation was applied on the items of underground conduit and meters; these items were not depreciated in the company's report.

Although the commission made a thorough investigation of both the Standard Electric Light Company and the Kansas City Heating Company, the report of the commission's chief accountant deals solely with the Kansas City Electric Light Company. The accountant's report does not take cognizance of working capital. The commission's engineers allowed for these items: Kansas City Electric Light Company, stores $123,303, cash $376,800; Kansas City Heating Company, stores $13,603, cash $23,200; total all companies, stores $136,906, cash $400,000; total, $536,906.

The books of the company show the investment (or cost new) in the Kansas City Heating Company, as of Jan. 31, 1914, as $838,553, and in the Standard Electric Light Company for the same date as $273,013, or, for the two properties, $1,111,566. With the working capital the total is $1,648,472.

The commission's report shows that the value of the Kansas City Electric Light Company alone, as disclosed by its records, is $6,264.430. From this the accountant deducted $958,286, giving a total value of the property alone now in existence of $5,306,144.

Of the deductions made by the commission the company has already deducted $605,610. Further deductions are recommended by the commission and acquiesced in by the company because of superseded property not yet written off, aggregating $107,236, making for these two items $713,846. The commission has further deducted bond discount of $231,186 and $14,253, or $245,439. The aggregate of these items is $958,285. The last item represents the cost to the light company of a steam-heating system purchased from the Edison company in 1900, and in the commission's report this has been eliminated on the basis that it constitutes a part of the steam-heating plant and is not a portion of the light plant.

The commission, therefore, has deducted approximately $340,000 from the company's total, of which $231,186 represents bond discount and $107,000 represents items the deduction of which the company recognizes as a fair procedure and is willing to make. After these total deductions of the commission there remains: The plant value of the Kansas City Electric Light Company (as per its books of Jan. 31), $5,306,144. From which the depreciation reserve of $1,310,-422 is deducted, leaving a depreciated plant value of the Kansas City Electric Light Company alone of $3,995,722. Between Jan. 31, 1914, and Nov. 30, 1914 (according to the commission) there was added new property aggregating $302,000. The depreciation reserve in the same period was increased $162,000, making an addition to the depreciated value of $140,000.

Pennsylvania Commission

Governor Brumbaugh sent to the Senate on May 19 his nominations for members of the commission. He retained only two of the old members, Messrs. Samuel W. Pennypacker and M. J. Brecht. The new members of the commission are Messrs. John S. Rilling, Erie, nine-year term; William A. Magee, Pittsburgh, eight years; John Monoghan, Philadelphia, six years; Edgar R. Kiess, Williamsport, five years, and William D. B. Rainey, Montrose, four years. Chairman Pennypacker is named for the ten-year term and Mr. Brecht for seven years.

Wisconsin Commission

The commission has ordered the Wisconsin-Minnesota Light & Power Company to enlarge the capacity of its distribution system and service installations for heating service in La Crosse and to keep a systematic record of temperature, differential pressure and flowage conditions in its system. The order is the result of an alleged inadequacy of service due to insufficient capacity of mains and to a deteriorated temperature-regulating system. In order to improve its service further the company is ordered to install at its own expense hydraulic thermostats in lieu of the existing pneumatically operated thermostats; to control and keep locked valves connecting mains with service installations; to specify the size and location of service installations, to install such equipment, and, if installed by others, to require that the plans for such installation be submitted to and approved by it prior to the granting of service. It is the intention of the commission that the company alone shall be responsible for the standard of service. The request of the defendant that it be permitted to discontinue the furnishing of heat to certain of its present consumers where the service has been unsatisfactory was denied by the commission. The company will be required to make further improvements should those now ordered prove insufficient. The commission will, however, entertain a petition for an increase in rates if such increase is necessary to give adequate service.

Personal

Mr. A. L. Sigler is contract agent for the Mobile Electric Company of Mobile, Ala.

Mr. J. E. Cornell has succeeded Mr. C. M. Shaw as manager of the Needles (Cal.) Gas & Electric Company.

Mr. John G. Barber has succeeded Mr. John Coffee Hays as president of the Yosemite Power Company, La Grange, Cal.

Mr. W. H. Francis, of the Edison Electric Illuminating Company of Boston, Mass., has been elected president of the Association of Edison Purchasing Agents.

Mr. Max Vestal, formerly electrical engineer of the Yakima Valley Transportation Company, North Yakima, Wash., has been appointed superintendent of way and equipment.

Mr. Fred S. Wheeler, who has been in the employ of the General Electric Company for four years, has resigned to become chief electrical engineer for the Seward Dredging Company of New York. Mr. Wheeler is now on his way to Alaska.

Mr. Thomas Hilliard, of St. Catharines, Ont., who has been appointed secretary of the Canadian government purchasing commission which has charge of expenditures for war material, is an electrical engineer and was for a number of years sales manager for the Canadian General Electric Company and later for the Canadian Crocker-Wheeler Company. Mr. Hilliard's new headquarters will be in the Booth Building, Ottawa.

Mr. William J. Barker, vice-president and general manager of the Denver (Col.) Gas & Electric Company, has returned to his office after having been confined to his room for several months, following an injury to his hip by a fall last December. The appearance of Mr. Barker at his office was the signal for a general reception by the employees of the company, who enthusiastically greeted the manager on his return to active duties.

Mr. Thomas F. Kelly, formerly sales manager of the Dayton Power & Light Company, Dayton, Ohio, has been elected to the position of commercial manager by the company's board of directors, and with Mr. O. H. Hutchings, associate general manager of the company, will have charge of the activities of the company in the absence of Mr. Tait, who has moved to New York City to become associated with the Brady interests, which own the Dayton property.

Mr. Henry L. Doherty was given a dinner at Davidson's, New York, on the evening of May 14, his forty-fifth birthday, by more than a hundred of his co-workers. In his remarks Mr. Doherty asked every employee of the central office to help in working out a plan that would increase the contentment of the men, particularly in the smaller plants. He paid a tribute to Elbert Hubbard, who lost his life when the *Lusitania* was sunk by a German submarine. An entertainment program was furnished by members of the staff.

Mr. Alexander MacKenzie has been elected president of the Brazilian Traction, Light & Power Company, Ltd., to fill the vacancy created by the death of Dr. F. S. Pearson, who perished on the *Lusitania*. Mr. MacKenzie was also elected president of the Rio de Janeiro Tramway, Light & Power Company, Ltd., the Sao Paulo Tramway, Light & Power Company, Ltd., and the Sao Paulo Electric Company, Ltd., by the boards of these companies. Mr. MacKenzie has been prominently identified with the Brazilian companies since their inception and was for many years general counsel and resident vice-president in Brazil.

Prof. Heike Kamerlingh Onnes, to whom was awarded the Franklin Medal at Franklin Institute on the evening of May 19, was born on Sept. 21, 1853, at Groningen, Holland, where his father was engaged in the manufacturing business. In 1882 he and Prof. H. A. Lorentz were appointed professors of physics in the University of Leiden. Professor Onnes devoted his energies to the creation of a laboratory for experimental research. Professor Lorentz directed his work mostly in the fields of theoretical and mathematical physics. The representative work of the laboratory has been in the field of molecular physics, and particularly in research at low temperatures. In later years the Netherlands government had granted considerable appropriations for the extension and equipment of the laboratory and thus permitted a new era of constantly increasing low-temperature research. On July 10, 1908, the gas helium was reduced to the liquid state. In the last few years Professor Onnes has made remarkable discoveries with reference to the electrical resistance of certain metals at temperatures only a few degrees above the absolute zero of temperature.

Mr. Douglass Burnett, who was elected chairman of the Commercial Section of the National Electric Light Association to succeed Mr. E. L. Callahan at the time of Mr. Callahan's resignation in February, was formerly vice-chairman of the section and for the last eleven years has been manager of the electrical commercial department of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md. Mr. Burnett was born in Brooklyn, N. Y., received his early schooling there, and was graduated from the scientific school of the Brooklyn Polytechnic Institute in 1890. Later he had charge of classes in physics and chemistry in the local manual-training high school, and for five years served as instructor of chemistry at Pratt Institute, Brooklyn. Entering the employ of the New York Edison Company in 1894, he was made inspector of isolated plants, and later was appointed superintendent of the "annual survey," in charge of testing customers' installations and feeder mains. In 1897 he became assistant general agent of the company's wholesale department, with direct charge of canvassing for service to new buildings and to isolated plants. It was on Feb. 1, 1904, that Mr. Burnett joined the staff of the Baltimore company's electrical department, assuming his duties less than a week before the great fire of 1904, so that he was called upon to meet severe conditions under the stress of that emergency. Mr. Burnett has been active in the work of the Commercial Section since it was first founded, and at the time of his election to chairmanship of the body was one of its vice-chairmen as well as chairman of its finance committee.

DOUGLASS BURNETT

Obituary

Edwin W. Crocker, for the last fifteen years superintendent of the East Haddam Electric Light Company's plant at East Haddam, Conn., was killed by electric shock May 9, when he accidentally came in contact with a wire on which he was working.

Frank W. Balfour, a veteran district manager of the Southern California Edison Company, died at Pomona, Cal., on April 25. He was the first district manager of the Southern California Power Company and was retained in the same capacity when the Southern California Edison Company took over the properties.

George Maurice, manager of the heating and lighting department of the General Electric Company, Ltd., of London, England, and one of the directors of the company, was a passenger on the steamship *Lusitania*, which was sunk by a German submarine on May 7, and is reported lost. Mr. Maurice had been in this country for several weeks. As he had made numerous trips here he had many friends in the country.

Walter S. Wright, attorney of the Southern California Edison Company, died at his home in Pasadena, Cal., May 1, after an illness of six weeks. Mr. Wright, with William R. Staats and George S. Baker, was one of the organizers of the West Side Electric Company of Los Angeles, which finally became the Southern California Edison Company. Mr. Wright had been a leader in the legal profession and in important improvements of a semi-public nature in the vicinity of Los Angeles for thirty years.

Corporate and Financial

Associated Gas & Electric Company, New York, N. Y.—During the year ended Dec. 31, 1914, the company, according to its annual report, disposed of its securities of the Canisteo Gas Company and the Hornell Gas Light Company, and acquired a further interest in the Kentucky Public Service Company and the Norwich Gas & Electric Company, besides acquiring the remaining outstanding bonds of the Ithaca Electric Light & Power Company. The company retired $19,000 bonds of underlying companies and canceled $213,000 of its own first mortgage bonds and collateral-trust 5 per cent gold bonds. The statement for the year follows:

Gross earnings from operation		$631,548
Operating expenses and taxes		398,760
Net earnings from operation		$232,788
Other income:		
Interest and dividends		27,354
Gross income for year		$260,142
Less deductions subsidiary companies:		
Interest on bonds not held by Associated Gas & Electric Company	$49,531	
Interest on floating debt not held by Associated Gas & Electric Company	1,058	
Sinking fund	13,825	
Amortization of debt, discount and expense and fixed capital	3,997	
Dividend on stock not owned by Associated Gas & Electric Company	1,141	
Proportion surplus reserved for minority stockholders	839	70,391
Balance available for Associated Gas & Electric Company		$189,751
Less interest		105,766
Balance available for dividends		$83,985
Dividend on preferred stock		54,419
Surplus		$29,566
Profit on sale of securities of Canisteo Gas Company and Hornell Gas Light Company		11,129
Total		$40,695
Amortization of debt, discount and expense		10,310
Surplus for year		$30,385

Great Western Power Company, San Francisco, Cal.—The growth in business in the past four years, according to E. H. Rollins & Sons, Chicago, Ill., is shown by the fact that income from the sale of electrical energy for the years ended Dec. 31, 1911, 1912, 1913 and 1914, was, respectively, $1,938,859, $2,306,553, $2,698,214 and $2,681,099. The output for the same years was, respectively, 210,287,168 kw-hr., 295,286,481 kw-hr., 333,305,125 kw-hr. and 315,103,250 kw-hr. The average price of energy, therefore, in 1911 was 9.22 mills per kw-hr.; in 1912, 7.81 mills; in 1913, 8.09 mills, and in 1914, 8.51 mills. The increase in average return per kilowatt-hour after 1912 is attributed in part to a smaller delivery of energy to the Pacific Gas & Electric Company at the low price prevailing under a contract and in part to a better average sale price for the business being connected to the company's distributing lines. The high average return for 1911 resulted from the fact that a preponderance of the business was in San Francisco, the return from which, it was stated, was substantially above the average. The number of customers has increased from 4228 in 1911 to 16,998 in 1914, and connected load increased from 110,000 hp in 1911 to 171,000 hp in 1914.

International Steam Pump Company, New York, N. Y.—The stockholders' and bondholders' protective committees have adopted a plan of reorganization. While no details have been made public, it is understood that another start will be made without funded debt, and that securities to be issued will consist of first preferred, second preferred and common stock.

Marconi Wireless Telegraph Company of America, New York, N. Y.—In the annual report of the company for the year ended Dec. 31, 1914, it is stated that the acquisition in 1912 of the tangible assets of the United States Wireless Telegraph Company placed under the company's control all of the coast stations of importance on both the Atlantic and Pacific coasts, besides which practically the whole of the American mercantile marine is at present fitted with wireless apparatus. The number of ship and shore equipments now operated by the company is approximately twenty times that of three years ago. Through exhaustive study of present requirements and future needs many vital readjustments in administration policies have been effected, a searching investigation has been made to determine manufacturing costs, and the operations of the company have been placed on a basis which is fair and equable to patrons but allows the company a greater margin of profit. Aside from supplying apparatus for new installation contracts, the factory at Aldene, N. J., is steadily engaged in producing improved equipments, with the object of gradually replacing all apparatus now in service which is out of date. To secure a return commensurate with investment and cost of operation it was found necessary to raise the rental figure of the ship-equipment contracts which were acquired with the purchase of the assets of the United Wireless Telegraph Company. As fast as these contracts expired the company has endeavored to make new ones on a more equable basis and with the provision for the increased cost of operation due to the necessity of maintaining the great number of shore stations required to give the steamships the service they need and the public the full margin of safety under the regulations of the United States radio act. In the northern district on the Pacific Coast—probably the largest in point of territory in the Marconi organization—there has been completed a powerful station at Ketchikan, Alaska, and a chain of wireless stations to cover this territory has been planned. At Juneau the company has another station under construction, and the United States terminal at Astoria, Ore., is nearing completion. This latter plant, which was to be ready about May 1, will be the first link in the chain to be opened to public service. Beginning with November, the curtailment of the revenue from long-distance press service and ship traffic caused distinct losses over previous years, yet prior to that time, and notwithstanding the war, the company's message traffic between shore and ship every month showed an increase over previous years. All expenditures for new construction have been reduced by postponing such work as was not immediately necessary. Economies have been effected in all stations where it has been possible to reduce the staff and hours of operation, and expenditures of all kinds receive the most careful scrutiny before being authorized. The directors have decided on a policy of depreciation and depreciation-reserve and have set aside from the operating revenues substantial amounts for the purpose of creating and maintaining proper and adequate depreciation reserve, first, to cover those losses defined by the Interstate Commerce Commission as "suffered through current lessening in value of tangible property and wear and tear not covered by current repairs," and, second, to meet depreciation of patents and patent rights.

Marion Light & Heat Company, Marion, Ind.—The company has petitioned the Public Service Commission for authority to issue $111,800 preferred stock to reimburse its treasury for expenditures made for betterments and improvements.

Merchants' Heat & Light Company, Indianapolis, Ind.—The company has received authority from the Public Service Commission of Indiana to sell $523,000 bonds and to issue stock of the par value of $144,000. The proceeds are to be issued to reimburse the company for amounts borrowed and expended for permanent additions and improvements. It is represented in the petition filed that subsequent to June 30, 1914, and prior to April 1, 1915, the company made permanent extensions amounting to $1,061,751. The extensions made have been largely those required in constructing parts of the new lighting system for the city of Indianapolis, the contract for which the company has for a period of ten years.

National Properties Company, New York, N. Y.—The company has taken over the management of the Jersey Central Traction Company and the Middlesex & Monmouth Electric Light, Heat & Power Company, which were purchased recently by Laird & Company of Wilmington, Del. The properties were formerly owned by Morris Brothers, of Philadelphia, Pa.

Pacific Gas & Electric Company, San Francisco, Cal.—The remaining $1,500,000 of the company's one-year 5 per cent notes due Dec. 15, 1915, has been called for redemption on May 27. The redemption will retire all floating debt.

Public Service Corporation of New Jersey, Newark, N. J.—The New York Stock Exchange has listed $261,000 additional general mortgage 5 per cent sinking fund fifty-year bonds, making the total amount listed $37,261,000.

The Montana Power Company, Butte, Mont.—The New York Stock Exchange has listed $6,000,000 additional first and refunding mortgage 5 per cent sinking-fund bonds, Series A, due 1943, making the total amount listed $16,000,000

United Gas Improvement Company, Philadelphia, Pa.—In his annual report for the year ended Dec. 31, 1914, Mr. Samuel T. Bodine, the president, states that the estimated expenditures for 1915 for extensions and improvements by the various leased works and the properties in which a majority of the stock is owned aggregate $4,467,406. Provision has been made for these requirements. The comparative statement for 1913 and 1914 follows:

Earnings:	1914	1913
From regular sources	$6,911,731	$7,142,388
From special sources—extra dividend on stock of one of the companies in which this company is a shareholder	.....	410,000
Profit from sale of securities	2,172,812	1,060,806
Total earnings	$9,084,543	$8,613,194
Expenses and taxes	1,888,143	1,142,087
Net profits	$7,896,400	$7,471,107
Dividends	$4,440,236	$4,440,236
Sinking funds	801,300	790,500
To undivided profit account	2,654,864	2,240,371
	$7,896,400	$7,471,107

United Public Service Company, Rochester, Ind.—The company recently filed a mortgage to secure an issue of $1,000,000 bonds. Several other northern Indiana plants will be acquired and service lines extended materially. The corporation has already acquired the electric light and water plant at Bourbon, Ind.

Utah Power & Light Company, Salt Lake City, Utah.—The budget of the company carrying appropriations amounting to approximately $1,000,000 for improvements during the coming year has been approved. In speaking of the subject, Mr. C. E. Groesbeck, general manager of the company, stated: "Although our budget for the rest of this year does not carry any great amount for the development of new territory, it does carry approximately $1,000,000, which will be spent mostly in Utah for rebuilding present lines and carrying out the work now in hand."

Washington (D. C.) Utilities Company.—The company has sold $1,500,000 of one-year 5 per cent collateral notes, the proceeds of which will be used to take up an equal amount of one-year notes maturing on May 1, 1915.

Western Power Company, San Francisco, Cal.—An issue of $1,000,000 of two-year 6 per cent collateral-trust gold notes, due on March 1, 1917, is offered at 99 and interest. It is estimated that the present market value of the collateral security is about 30 per cent in excess of the par value of the notes.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.—It has been announced that the new bonds to be issued by this company in the place of those outstanding will be convertible at par into common stock on and after June 30, 1916, at the rate of $910 in par value of stock for each $1,000 bond. In a statement issued to the holders of the outstanding convertible bonds, Mr. Guy E. Tripp, chairman of the company, after pointing out that the company wants to place itself in a position to sell stock at par, says: "The company, therefore, offers to bondholders the opportunity to participate in a plan which provides for the retirement of the existing bonds upon terms which, if said plan be consummated, will result in each bondholder receiving either: (a) an equal amount of new bonds differing from the existing bonds in omission of the restrictive covenant and in that, instead of being convertible into common stock at the rate of $500 par value of stock for each $1,000 bond, they shall be convertible into such stock at the rate of $1,000 par value of stock for each $1,000 bond on or before June 30, 1916, and thereafter, at any time prior to maturity, at the rate of $910 par value of stock for each $1,000 bond; or (b) cash for deposited bonds at 105 per cent and accrued interest; or (c) part cash and part new bonds at said rates; or, in case said plans are not consummated, (d) the return of deposited bonds without expense to the depositor." The new bonds will not be redeemable prior to Jan. 1, 1917. On and after that date they will be redeemable upon the same terms and conditions as the existing bonds.

Manufacturing and Industrial

The E. W. Bliss Company, Brooklyn, N. Y., has opened an office and wareroom at 622 West Washington Street, Chicago, Ill.

The Carr & Schultz Electric Company, Perry and Stockton Streets, Trenton, N. J., is about to engage in the supply and construction business.

Edwin C. Lewis, Inc.—Messrs. J. B. Ward and T. J. O'Brien have become associated with Edwin C. Lewis, Inc., 121 Federal Street, Boston, Mass.

Schweitzer & Conrad, manufacturers of high-tension equipment, have moved from 1770 Wilson Avenue, Chicago, to Berteau and Ravenswood Avenues, Chicago.

The Adams-Bagnall Electric Company, Cleveland, Ohio, has opened an office at 1434 Syndicate Building, St. Louis, Mo., which will be in charge of Mr. H. E. Merrithew.

The Electric Cable Company, 17 Battery Place, New York, has appointed Mr. J. W. White, formerly with the Union Switch & Signal Company, as a member of its sales force.

Mr. Frank Barrington, formerly of the St. Louis sales office of the Westinghouse Lamp Company, has been appointed district sales manager of the company for Pittsburgh, succeeding Mr. H. J. Solon.

The Whiting Foundry Equipment Company, Harvey, Ill., has acquired the foundry-equipment business of the Central Iron Works, Springfield, Ill., and will manufacture the dust arresters and water cinder mills hitherto made by the latter concern.

The Electric Meter Corporation, 55 Liberty Street, New York, has recently been formed "to render sub-meter and expert engineering service." Mr. F. A. Forgee, for a number of years consulting electrical and mechanical engineer, is president of the company.

W. F. Cummings, of Chicago, a firm of engineers and contractors, has moved its main office from 1107 City Hall Square Building to 330 South Paulina Street. This movement consolidates the company's main office and construction office and concentrates its forces.

Electrical Shop at Tarentum, Pa.—Mr. Guy F. Bole, who for twenty-seven years was chief engineer of the Pennsylvania Salt Manufacturing Company, Tarentum, Pa., has severed his connection with that company to open a completely equipped electrical salesroom at Tarentum.

Mr. F. D. Sweet, who during the last two years has been manager of the Indiana territory for the Federal Sign System (Electric), has accepted a position as district manager for the American Sign Company of Kalamazoo, Mich. Mr. Sweet will make his headquarters at 305 North Michigan Avenue, Chicago, Ill.

The Hercules Instrument Company, Mount Vernon, N. Y., has acquired the sole right to manufacture and sell the tubular ammeters made by the Benford Manufacturing Company, also of Mount Vernon. A tubular instrument made by the Benford company was described in the ELECTRICAL WORLD of April 3.

The Monowatt Electric Import Company, 335 Broadway, New York, has recently been incorporated and will act as a jobber of electrical novelties and nitrogen-filled lamps. Mr. P. F. Altschul, former proprietor of the Monowatt Electric Import Company (not incorporated), is president and treasurer of the company, and Mr. N. Schwartzer is secretary.

The Drake-Clapp Electric Company, Los Angeles, Cal., has recently been incorporated and has opened an electric store for heating and household appliances at 217 West Fourth Street. Mr. A. G. Drake, formerly with the Woodill & Hulse Electric Company, is president, and associated with him are Mr. J. G. Drake and Mr. R. B. Clapp, formerly with the Westinghouse Electric & Manufacturing Company.

Order for Electric Furnace.—The Dayton (Ohio) Steel Foundry Company has placed an order for a one-ton electric furnace with the Snyder Electric Furnace Company, 53 West Jackson Boulevard, Chicago, Ill. The furnace is designed to melt and refine cold scrap on a basic lining, producing refined steel castings. The Dayton Steel Foundry Company is a manufacturer chiefly of high-grade steel castings for the automobile and machinery trade.

English Representative to Buy Lighting Materials.—Mr. E. H. Spicer, representing Spicer & Company, Ltd., of London, has arrived in New York and desires to purchase several types of insulated brass lamp bases, lighting glassware, and tungsten and molybdenum ore or metal for filaments. Mr. Spicer is making his temporary headquarters at the branch office of the Bureau of Foreign and Domestic Commerce, Room 409, Custom House, New York City.

W. N. Matthews & Brother Send Cake by Mail.—In an unusual advertising campaign which W. N. Matthews & Brother, of St. Louis, Mo., are conducting, and which is called the "Matthews cake campaign," many favors have been distributed to the firm's prospective customers as their "slices" of the Matthews profit-sharing cake. Slices of real cake which were distributed through the mail inclosed in tissue paper and a cardboard carton were among the unusual and most acceptable favors sent out.

Conduit Plant Damaged by Fire.—The plant of the National Enameling & Manufacturing Company, of Youngstown, Ohio, where the company makes a large line of clay and enameled conduits, insulators and similar goods, was almost destroyed by fire last week, with a loss estimated at about $50,000. The company's officers have stated that until matters are straightened out and the exact nature and amount of the loss are ascertained it will be impossible to announce rebuilding plans. Insurance to the amount of about $31,500 on the plant and its contents will reduce the net loss.

The Rutenber Electric Company of Logansport, Ind., has moved its factory, offices and salesroom into a fireproof three-story concrete building in the retail district of the city. The several departments of the company now occupy 15,000 sq. ft. of floor space. In the 60-ft. by 30-ft. offices and salesroom on the first floor of the building electric ranges and other Rutenber products are attractively displayed. The present location of the company enables it to reach the local retail trade. Officers of the company are: Mr. E. A. Rutenber, president; Mr. J. F. Digan, vice-president, and Mr. J. E. De Long, secretary-treasurer.

Choice of Proper Sockets for Fixtures Going Abroad.—Commercial Attaché A. H. Baldwin in reporting from London, England, states that American manufacturers of ornamental lighting fixtures who are endeavoring to place their products in foreign countries should first obtain full particulars with respect to the type of socket employed in the various countries before making shipments. He mentions that his attention was recently directed to a shipment of fixtures equipped with the form of sockets generally used in the United States, but which differ from the British form, making the American fittings almost useless.

Penn Electric Company Occupies New Factory.—The Penn Electric Company has started work in its new factory in West Irwin, Pa. The present building replaces the one which was destroyed by fire on Christmas Eve. It is a fireproof structure and represents an investment of $40,000. The company will confine its efforts for the present to the manufacture of high-grade switchboards, panelboards and knife switches for pressures of 125 volts to 300 volts. The officers of the company are Mr. F. D. Hockensmith, president; Mr. W. D. Hockensmith, vice-president; Mr. W. F. O'Neil, secretary-treasurer, and Mr. A. N. Rogers, chief engineer.

Large Power Cable for Brooklyn Navy Yard.—A large cable which has been specially made for the United States government by the Hazard Manufacturing Company, Wilkes-Barre, Pa., is designed for use between a substation and a dock at the Brooklyn Navy Yard, where warships are tied. As soon as a ship is made fast to the dock, energy is taken from the substation, being transmitted through the cable while the electrical plant on the ship is shut down. The cable has a copper section of 2,000,000 circ. mils and is provided with a 5/32-in. insulation wall of 30 per cent Para rubber which is covered with tape, a ⅛-in. lead sheath, two layers of tarred jute and a layer of No. 4 galvanized armor wire. The diameter of the cable is 3 in. and the weight is 16 lb. per ft.

Equipment for 300-Kw Plant at Pratt, Kan.—The Western Electric Company has received the contract, amounting to about $14,000, for the electrical equipment for the municipal light plant to be installed at Pratt, Kan., by the Connor Construction Company, of Kansas City, Kan. Included in the order is one 187-kw alternator, one 125-kw alternator, a five-panel switchboard, a street-lighting regulator, and eighty "white-way" iron poles, one-half of which are three-lamp standards and the other half two-lamp units. The engines were furnished by the C. A. Burton Machinery Company. The new plant is designed to care for the lighting business and perhaps some motor load. At present a private plant, which also runs a mill, is the only source of electric service in the town.

Selling Socket Parts Separately.—The Hart & Hegeman Manufacturing Company, Hartford, Conn., selling agents for the H. T. Paiste Company, Philadelphia, Pa., announces that the sockets made by the latter company are now being sold unassembled. Each cap, base and shell, with interior, is boxed separately and can be bought independently. From a stock of a few parts, it is declared, four to five times as many different types of sockets can be assembled, and because of the small number of different pieces handling of the product is facilitated. To make ordering easy, each part is designated by a letter or number, and an illustrated sheet is provided showing the different parts with descriptions and prices. The numbers and letters under each illustration designate the standard package, schedule and price list. In ordering assembled sockets the letter and number of the desired cap and shell are combined.

Manufacturer's Display of Electric Lamps.—An exhibition of various types of electric lamps was inaugurated May 15 by the New York Edison Company in its showrooms at 124 West Forty-second Street and at Irving Place and Fifteenth Street, New York City. The exhibition included demonstrations of some of the newer methods in semi-direct and indirect illumination. Fixtures were loaned by the following designers and makers of New York City: Art Metal Works, 347 Fifth Avenue; Bayley & Sons, 101 Park Avenue; Cassidy & Son Manufacturing Company, 133 West Twenty-third Street; S. W. Farber, 34 Union Square; the Handel Company, 200 Fifth Avenue; the Homelight Company of America, 1955 Park Avenue; the Kathodian Bronze Company, 501 Fifth Avenue; Mildred Richardson Kelly, 42 West Thirty-ninth Street; the Macbeth-Evans Glass Company, 145 Madison Avenue; Mastich & Graham, 8 East Thirty-seventh Street; Edward Miller & Company, 68 Park Place; the Mountain Community, Inc., 176 Madison Avenue; Mrs. J. M. McDowell, 7 West Forty-second Street; the National X-Ray Reflector Company, 21 West Forty-sixth Street; the National Metalizing Company, 333 Fourth Avenue; the Charles Parker Company, 32 Warren Street; Sibley & Pittman, 19 West Thirty-sixth Street; the W. H. Stavenhagen Company, 447 West Thirty-sixth Street; Weidlich Brothers, 200 Fifth Avenue, and the Will & Baumer Company, 141 Madison Avenue.

NEW YORK METAL MARKET PRICES

	May 11 — Selling Prices Bid	Asked	May 18 — Selling Prices Bid	Asked
Copper	£ s d		£ s d	
London, standard, spot*	77 12 6		77 10 0	
Prime Lake	18.75 to 19.00		18.75 to 19.00	
Electrolytic	18.50 to 18.75		18.50 to 18.75	
Casting	17.50 to 17.75		17.25 to 17.50	
Copper wire base	24.00		20.00	
Lead	4.20		4.20	
Nickel	42.00 to 45.00		45.00 to 48.00	
Sheet zinc, f.o.b. smelter	17.50		18.50	
Spelter	14.00 to 14.25†		15.25 to 15.50†	
Straits tin	40.37½		38.50	
Aluminum, 98 to 99 per cent	19.25 to 19.50		21.50 to 22.50	

***OLD METALS**

Heavy copper and wire	17.00	17.25
Bras, heavy	11.25	11.25
Brass, light	9.25	9.25
Lead, heavy	3.95	3.95
Zinc, scrap	10.50	10.50

***COPPER EXPORTS**

Total tons to May 18	19,972

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Independent Light & Power Company, of New York, N. Y., has been incorporated by Alex Werner, Helen White and Meyer Klein, 817 West End Avenue, New York. The company is capitalized at $100,000 and proposes to supply electricity for lamps, heaters and motors.

The Cayuga Power Corporation, of Ithaca, N. Y., has been incorporated with a capital stock of $75,000 by Frank S. Conneti, 132 Remsen Street, Brooklyn; Harold Stanley, of South Orange, N. J., and W. M. Rose, of Montclair, N. J. The company proposes to generate and distribute electricity.

New Industrial Companies

The Sommer Lighting Fixture Company, of New York, N. Y., has been chartered with a capital stock of $10,000. The incorporators are J. T. Booth, E. C. and C. R. Sommer, 386 Second Avenue, New York, N. Y.

The Electric Burglar Alarm Clock Company, of New York, N. Y., has been granted a charter with a capital stock of $15,000. The incorporators are W. Deutcher, 314 East 192d Street, New York; C. Kurzwell and Benjamin Ammerman, of Brooklyn, N. Y.

The Vaporel Corporation, of New York, N. Y., has been incorporated by W. J. Graham, F. C. Barrett and D. G. Griffin, 233 Broadway, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture electric vaporizers, sterilizers, appliances, etc.

The Idaho Power Company has filed articles of incorporation under the laws of the State of Maine with a capital stock of $10,000,000. The company proposes to deal in machinery, generators, motors, lamps or devices in connection with the use and distribution of electricity.

The Niagara Electric Improvement Corporation, of Buffalo, N. Y., has been incorporated by S. Pick, L. C. Nicholson, Buffalo, and R. C. Downing, of Syracuse, N. Y. The company is capitalized at $50,000 and proposes to manufacture electric meters, electrical apparatus and supplies.

The Kent Typewriter Company, of New York, N. Y., has filed articles of incorporation with a capital stock of $2,000,000 under the laws of the State of Delaware to manufacture, sell and deal in generators, dynamos and all equipment used in connection with generating electricity and transmission appliances. The incorporators are F. J. Leach, of Clyde, N. Y.; C. H. Smith, of Youngstown, Ohio; W. S. Pyfrer, of Kent, Ohio, and R. H. Nisbitt, of Akron, Ohio.

Trade Publications

Sign Receptacle.—A leaflet describing a receptacle for metal signs and outlet boxes has recently been issued by the Arrow Electric Company, Hartford, Conn.

Small Lighting Plant.—The Lauson-Lawton Company, De Pere, Wis., has prepared an illustrated catalog which describes its gasoline-engine-driven lighting outfit.

Time Switches.—Several types of time switches are described in a catalog issued by the Venner Time Switches, Ltd., 60 Queen Street, Westminster, London, S. W., England.

Electric Vacuum Cleaner.—A vacuum cleaner driven by a vertical 1/6-hp motor is described in a folder recently issued by the Thurman Vacuum Cleaner Company, St. Louis, Mo.

Pumps.—Pumps of the centrifugal, double-suction and multi-stage types are described in an illustrated catalog issued by the Providence Engineering Works, Providence, R. I.

Electric Sterilizers.—Electrically operated earthenware sterilizers for physicians' instruments and similar articles are described in several booklets recently issued by the Santiseptic Manufacturing Company, Tompkinsville, Staten Island, N. Y.

Electrically Operated Pumps.—Several types of electrically operated pumps are described and illustrated in a folder issued by the Luitwieler Pumping Engine Company, Rochester, N. Y.

Boiler-Room Appliances.—The Lagonda Manufacturing Company, Springfield, Ohio, has issued a booklet which contains illustrations of and information on various devices for use with boilers.

Motors for Band Saws.—Roth Brothers & Company, Adams and Loomis Streets, Chicago, Ill., have issued Bulletin No. 199, which contains information on direct-current motors for band saws.

Electric Flashlamps.—The Usona Manufacturing Company, 1 Hudson Street, New York, is sending out a folder which contains information on a number of types of flashlamps and electric lanterns.

Oil Engines.—The Muncie (Ind.) Oil Engine Company has issued its general Catalog No. 21, containing sixty-four pages of illustrated descriptive matter on oil engines and the company's factory methods.

Electric Bench Washer.—The Haag Brothers Company, 812 North Commercial Street, Peoria, Ill., has issued a folder which describes and illustrates its electrically operated bench washing machine.

Lamps for Sign Illumination.—The Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J., has just issued Bulletin No. 59, which describes several sign installations illuminated by its lamps.

Motion-Picture-Lamp Controller.—A device for controlling the feed of electrodes for motion-picture apparatus is described in a booklet recently issued by the Speed Controller Company, 257 William Street, New York.

Self-Contained Generating Set.—The Universal Motor Company, Oshkosh, Wis., is sending out a placard which contains information on an outfit consisting of a 3-kw generator directly connected to a four-cylinder gasoline engine.

Battery for Motor-Cycle Service.—The Electric Storage Battery Company, Philadelphia, Pa., has issued a bulletin designated as Section Z, third edition, which contains information on its Type Z "Exide" battery for motor-cycles.

Induction-Motor Starters.—Starters of the compensator and resistance-coil type for squirrel-cage induction motors are described in an illustrated catalog, designated as Bulletin 203-B, issued by Fairbanks, Morse & Company, Chicago, Ill.

Vertical Diesel Engines.—The Southwark Foundry & Machine Company, Washington Avenue and Fifth Street, Philadelphia, Pa., has prepared an attractively illustrated catalog which describes several types of its large-sized vertical engines operating on the Diesel principle.

Electric Ambulances and Delivery Wagons.—The General Vehicle Company, Long Island City, New York, has prepared two illustrated bulletins which describe its electrically operated ambulances and its electric delivery vehicles for department stores and high-class retailers.

Radiator-Type Transformers.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a bulletin, designated as Reprint No. 12, which contains an article entitled "Radio-Type Transformers for the New Haven System," reprinted from the ELECTRICAL WORLD of Feb. 20, 1915.

Instrument for Finding Defects in Cables.—W. N. Matthews & Brother, Inc., St. Louis, Mo., have issued a booklet entitled "Directions for Using Matthews Woodpecker Telefault," which contains information about this instrument for finding defects in various kinds of electric circuits and for locating concealed wires, pipes, etc.

Direct-Current Generators.—Bulletin No. 8 issued by the Hobart Brothers Company, Troy, Ohio, contains information on direct-current dynamos for motion-picture apparatus. Bulletin No. 6 issued by the same company describes and illustrates a small generator for lighting, and Bulletin No. 7 relates to a generator for charging batteries.

Ball Bearings for Machine Tools and Shop Equipment.—The S K F Ball Bearing Company, 50 Church Street, New York, has issued Bulletin No. 25, entitled "S K F Ball Bearings in Machine Tools and Shop Equipments." The catalog is well illustrated and contains information on the uses of ball bearings in lathes, drill presses, milling machines, grinding machines, etc.

Construction News

New England

WESTBROOK, MAINE.—The Westbrook El. Co., recently incorporated with a capital stock of $200,000, has taken over the property of the Presumpscott El. Co., of Westbrook, which furnishes electrical service in Westbrook and Gorham. The officers are B. L. Merryman, of South Portland, president, and William S. Linnell, of Portland, treasurer.

ST. ALBANS, VT.—The City Council is considering the question of changing the street-lighting system from arc to incandescent lamps. The street-lighting service is furnished by the Vermont Pwr. & Mfg. Co., of St. Albans.

BOSTON, MASS.—Bids will be received by the Trustees for the Children of Boston, 49 City Hall, Boston, until June 1 for installing a 15-kw engine-driven electric generating unit (directly connected), at Rainsford Island. Proposal form may be obtained at Room 602, City Hall Annex.

BOSTON, MASS.—The Bay State St. Ry. Co., of Boston, has petitioned the Public Service Commission for permission to issue $1,500,000 in capital stock, the proceeds to be used as follows: For line and track construction, $371,999; for cars and rolling stock, $142,822; for power stations and machinery, $135,377.

BOSTON, MASS.—Bids will be received by the Schoolhouse Commissioners of the city of Boston, Room 1009, City Hall Annex, Boston, until May 25 for furnishing and installing vacuum cleaning system in the High School of Commerce, Avenue Louis Pasteur, Boston. Proposal blanks may be obtained at the office of the commissioners.

BOSTON, MASS.—Bids will be received by Richard A. Lynch, superintendent of public buildings, 802 City Hall Annex Building, for constructing and completing a police station and school administration building on the site of the old Probate Building, Court Square, Boston, according to plans and specifications, for which a deposit of $25 will be required, to be refunded upon return of same.

LYNN, MASS.—The State Gas and Electric Light Commission has authorized the Lynn Gas & El. Co. to issue 4425 shares of additional capital stock at a par value of $100, to be issued at $240 per share, the proceeds to be used for extensions and improvements to its system.

LYNN, MASS.—Contracts, it is reported, will be awarded by H. L. Gilman and W. A. Armes, architects, 8 Congress Street, Boston, Mass., about June 20 for construction of buildings for the Lynn Mill Corpn., as follows: One mill building, 125 ft. by 700 ft., four stories high, to cost about $40,000; a warehouse, 100 ft. by 700 ft. (one story), $40,000, and a power plant, to cost about $100,000.

MILFORD, MASS.—The town of Milford has engaged William Plattner, of Attleboro, electrical engineer, to make investigations in regard to the advisability of the town purchasing the plant of the Milford El. Lt. & Pwr. Co.

PEPPERELL, MASS.—Work has been started on the auxiliary power plant for the Pepperell Mfg. Co., which will be located on the river bank a short distance from the present power plant of Laconia division. The equipment will include a 4000-kw steam turbine and four 500-hp water-tube boilers.

STERLING, MASS.—Preparations are being made for extending the municipal electric-lighting system to Sterling Junction, Rowley Hill district and to Chocksett district, involving an expenditure of $6,000. Equipment required will include transformers of various ratings, 425 chestnut poles (which will be bought locally), 2000 insulators, No. 6 copper wire, and single-wire Westinghouse lightning arresters. H. W. Rugg, manager of the municipal electric-light plant, has charge of the work.

EXETER, R. I.—Bids will be received by the Board of Control and Supply, Room 18, State House, Providence, until May 27, for the installation of a central power-plant equipment and electrical work, steam work in connection with central plant, laundry equipment, water-pipe extension and sewer extension for the Rhode Island School for Feeble-Minded at Exeter. William A. Schofield is chairman of board.

HOWARD, R. I.—Bids will be received by the Board of Control and Supply, Room 18, State House, Providence, until May 27, for a cold-storage plant, elevator machinery and equipment for a new bakery for the general storehouse and bakery at Howard. The Richard D. Kimball Co., 6 Beacon Street, Boston, Mass., has charge of the engineering work.

Middle Atlantic

CENTRAL ISLIP, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until May 26 for extension to laundry, construction, heating, plumbing and drainage and laundry equipment for addition to storehouse; for refrigerating plant, construction, plumbing and drainage, electric work and refrigerating equipment at the Central Islip State Hospital, Central Islip. Drawings and specifications and blank form of proposals may be obtained at the Department of Architecture, Capitol, Albany, upon deposit of $10.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until June 1, for additions, alterations and repairs to the electric equipment in Public Schools 25, 31, 44, 62, 177 and 188, borough of Manhattan. Blank forms, plans and specifications may be obtained or seen at the above office.

NEW YORK, N. Y.—Bids will be received by William Williams, commissioner of water supply, gas and electricity, Room 2342, Municipal Building, New York, until May 27 for furnishing 1500 cast-iron lamp-posts, with steel shafts. Blank forms, together with copy of contract, including specifications, may be obtained upon application at the office of the department, Room 2324, Municipal Building, where plans and specifications may be obtained.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until June 1 for furnishing and delivering materials for use of mechanics (electrical division, building bureau) in the public schools of the city of New York, boroughs of Manhattan, the Bronx, Brooklyn, Queens and Richmond. Blank forms and specifications and further information may be obtained at the above office.

PAWLING, N. Y.—The Public Service Commission has approved the exercise of franchises granted to Ralph Griffing by the town of Pawling for the installation of an electric-lighting plant here.

RIPLEY, N. Y.—The installation of a municipal electric-lighting plant in Ripley is under consideration.

SILVER CREEK, N. Y.—The local electric-light plant has been purchased by John Kimmei, who will take over the property at once.

ALLENTOWN, PA.—A large three-story school building will be erected by the Board of Education in Allentown. The plans provide for heating, ventilating and electrical installations.

BOWMANSVILLE, PA. — Arrangements are being made with the Palmerton El. Lt. Co to supply electricity to light the streets of Bowmansville.

EPHRATA, PA.—The Ephrata & Lebanon St. Ry. Co., of Ephrata, has applied to the Public Service Commission for permission to furnish electricity for lamps and motors in the towns of South Lebanon, Heidelberg and Clay Townships. F. C. Hornstein is manager.

HARRISBURG, PA.—The Public Service Commission has approved the following contracts: The United El. Co., of Canton, Ohio, with the township of Fairview for furnishing electricity for lamps and motors; the Pennsylvania Lt., Ht. & Pwr. Co. and the city of Pittsburgh for operating in the city of Pittsburgh.

HARRISBURG, PA.—The Harrisburg Lt. & Pwr. Co. expects to erect within the next six months 10 miles of 6900-volt transmission line; also to purchase within the next three months two 610-hp water-tube boilers, including ash-handling system, 54 single-lamp standards and 20,000 ft. No. 6 arc cable. The company has recently purchased 1000 electric irons. C. M. Kaltwasser is general manager.

LEHIGHTON, PA.—The citizens have voted to authorize a loan of $100,000 for the construction of a new high-school building. The plans provide for the installation of electrical and heating systems.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford, Arsenal, Philadelphia, until May 28 for the installation of underfeed mechanical stokers in the boiler room of the power plant at the Frankford Arsenal. Further information may be obtained upon application to the commanding officer, Frankford Arsenal, referring to circular advertisement No. 253.

READING, PA.—The Reading Transit & Lt. Co., we are informed, does not contemplate any work at this time. Reported in the issue of April 24 that improvements costing $165,000 would be made.

ST. CLAIR, PA.—Plans are being considered by the Council for improvements to the municipal electric-lighting plant.

WAYNESBORO, PA.—Arrangements are being made by the Waynesboro El. Lt. & Pr. Co. for extending its system in order to meet the needs of the communities through which its lines and those of the Chambersburg & Gettysburg El. Ry. Co. pass. The plans provide for the organization of a number of subsidiary companies to extend the franchise of the parent company to Washington, Antrim, Guilford and Quincy Townships. Applications for charters for the subsidiary companies have been made, signed by J. A. Strite, solicitor.

HARRISON, N. J.—The Crucible Steel Co. of America, of Harrison, it is reported, is contemplating the construction of a new power station in connection with extensions to its plant. The company is also considering the erection of a new electric substation.

TOMS RIVER, N. J.—The Toms River El. Co. expects to install within the next 30 days one 125-hp Coatesville boiler. C. A. Brant is secretary and manager.

CUMBERLAND, MD.—The City Council is considering the question of improvements to the municipal electric-lighting plant, to cost about $15,000. The plans provide for the installation of high-speed steam turbine (directly connected) and replacing the present street-lighting system with modern lamps.

CHATHAM, VA.—The Chatham Lt. & Pwr. Co. will begin work on the development of its White Falls property as soon as satisfactory arrangements can be made for the sale of its bond issue. The equipment of the proposed plant will consist of two 500-hp waterwheels (operating under a 40-ft. head), two alternators, switchboards, transformers and 14 miles of 20,000-volt transmission line from the hydroelectric plant to the present power house, which will be discarded on the completion of the new plant. B. F. W. Bryant is manager.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 24 for supplying to the various public buildings under the control of the Treasury Department hand, electric, portable vacuum cleaners during the fiscal year ending June 30, 1916. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 1 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 8312—22 side lamps. Newport, R. I., Schedule 8307—36 ¼-hp motors; Schedule 8309—miscellaneous copper tubing and miscellaneous steel tubing; Schedule 8278—two hand and power feed milling machines and one electric riveting machine. Washington, D. C., Schedule 8284—8000 lb. annealed welding wire. Bids will also be received at the same place until June 8 as follows: Brooklyn, N. Y., Schedule 8300—10 electric portable drills, 30 after-range lamps. Portsmouth, N. H., Schedule 8297—miscellaneous sheathing copper; Schedule 8304—97,500 lb. condenser tubes. Brooklyn, N. Y., Schedule 8303—miscellaneous sheet copper. Boston, Mass., Schedule 8304—miscellaneous brass voice tubing and miscellaneous composition unions. Applications for proposals should designate the schedule desired by number.

North Central

CHARLOTTE, MICH.—The installation of an ornamental lighting system in the business district is under consideration.

DETROIT, MICH.—Bids will be received by the Department of Public Works, City Hall, Detroit, until June 9 for construction of municipal court building in Detroit. Except where otherwise noted in specifications, each proposal is to include the entire building work and mechanical equipment. Plans and specifications may be obtained from Smith, Hinchman & Grylls, architects and engineers, Detroit, upon deposit of $25.

HOLLAND, MICH.—The lowest bid submitted for the construction of the municipal electric light and power station was submitted by J. H. Sullivan, of Grand Rapids, at $14,300.

ATHENS, OHIO.—The City Council is considering replacing the 250-cp "Mazda" lamps with 80-watt nitrogen lamps for street-lighting. The Hocking Pwr. Co. is making arrangements to reconstruct the municipal lighting system.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until May 28 for cedar poles for the Municipal Electric Light Department.

Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland.

CLEVELAND, OHIO.—The Board of Control has authorized an expenditure of $29,700 to equip the substation of the municipal electric-light plant on East Eleventh Street with converters to enable it to supply direct current in the downtown power field. Practically all the buildings in this district are equipped for direct current.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until May 27, for ornamental glass globes for park and boulevard lamps for the street-lighting division. Specifications may be obtained at the office of the superintendent of lighting, 413 Superior Avenue.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 511 City Hall, Cleveland, until June 8 for lighting fixtures for the new city hall building. Plans and specifications are on file in the office of the director of public service and at the office of J. Milton Dyer, architect, 825 Cuyahoga Building, Cleveland. Duplicate copies may be obtained from the architect upon deposit of $15, of which $8 will be refunded upon return of plans.

CORTLAND, OHIO.—The Cortland Ltg. & Pwr. Co., recently organized with a capital stock of $5,000, is planning to supply electricity for lamps, heaters and motors in Cortland. O. M. Richards and others are interested in the company.

DOVER, OHIO.—Bids will be received by Clifford Pease, village clerk, until June 1 for lighting the streets of the village for a period of 10 years.

FREMONT, OHIO.—Negotiations are under way, it is reported, for the purchase of the Ballville water-power plant by Chicago capitalists. If purchased, it is understood that the plant will be converted to a combined water and steam plant in order to maintain steady production, regardless of the stage of the Sandusky River. The proposed buyers are represented by W. G. Souders and C. J. Davidson, of Chicago, Ill., and A. B. Conant and S. Young, of Boston, Mass.

GREENVILLE, OHIO.—The County Commissioners have granted the Greenville El. Lt. & Pwr. Co. permission to erect electric transmission lines in Preble County for the purpose of transmitting electricity to the village of Verona.

MIDDLEPORT, OHIO.—The Mutual El. Co., of Middleport, has applied to the Public Utilities Commission for authority to purchase the electric generating plant and distributing system now held by Frank C. Elliott as trustee for $100,000. The company also asks for permission to issue $75,000 in stock and $75,000 in notes, of which $25,000 in stock and the $75,000 in notes are to pay for the property, and $50,000 in stock is to be sold at par, the proceeds to be used for improvements and betterments to plant.

MIDDLETOWN, OHIO.—The Ohio Gas & El. Co. has applied to the Public Utilities Commission for authority to purchase the property of the Middletown Gas & El. Co. of Middletown; the Franklin El. Lt. Co., of Franklin; the Leetonia El. Co., of Leetonia, and the New Lisbon Gas Company, of New Lisbon. The Ohio Gas & El. Co. also asks for permission to issue and sell $700,000 in bonds at 85, $200,000 in debentures at 80, and $795,000 in common stock at 70, to provide funds for the purchase of the properties, and to expend $42,500 on extensions and additions to the Middletown plant.

OBERLIN, OHIO.—The City Council is considering the question of installing a municipal electric-lighting plant and waterworks system.

RUSSELL, OHIO.—The City Council has authorized the city clerk to ask for bids for furnishing electricity for street lighting and for private and commercial purposes.

SANDUSKY, OHIO.—An electric-light and power plant, it is reported, will be provided for the new Alhambra Theatre. The equipment will include a 90-hp Bruce-Macbeth engine and a 50-kw generator, directly connected.

WARREN, OHIO.—Within the next two months the Trumbull Pub. Ser. Co., of Warren, expects to install one 3600-kw Curtis turbine with condenser and switchboard for above. E. L. Franklin is general manager.

YOUNGSTOWN, OHIO.—Plans are being considered by Lionel Evans, superintendent of parks, for lighting all of the city parks. All wires will probably be placed underground. H. Whitford Jones, of Cleveland, is consulting engineer.

LOUISVILLE, KY.—The Louisville Gas & El. Co., it is understood, will supply energy for the new plant of the Ford Motor Co., now under construction in Louisville. The total motor connected load will be about 350 hp and the lighting load from 70 kw to 80 kw.

LOUISVILLE, KY.—The plant of the Columbia Sanitary Mfg. Co., which is now being erected, will be equipped with electrically driven machinery. The motors will amount to 135 hp. Electricity for operating the plant will be purchased. The company, it is understood, is considering bids for equipment.

MOUNT OLIVET, KY.—The Robertson County Lt. & Pwr. Co., recently organized, contemplates the installation of an electric plant to develop about 60 hp in Mount Olivet.

PADUCAH, KY.—Plans are being considered by the Kentucky-Southwestern El. Ry., Lt. & Pwr. Co., of Paducah, for the construction of a new power plant in connection with its electric railway from Paducah to Murray. Fred M. Smith is general manager.

TOMPKINSVILLE, KY.—Improvements are contemplated to the local electric-light plant by the new owners, L. W. Preston, E. H. Smith and J. R. White, of Glasgow. The installation of a water system is also under consideration.

ANDERSON, IND.—The Public Service Commission has authorized the city of Anderson to issue $50,000 in bonds, the proceeds to be used for the installation of a stoker, boiler, turbine, switchboard and other apparatus in the municipal electric-light plant.

INDIANAPOLIS, IND.—The Merchants' Ht. & Lt. Co., of Indianapolis, has been authorized by the Public Service Commission to issue $533,000 in bonds and $144,000 in capital stock, the proceeds of which are to be used in part in paying for extensions to its transmission lines and for lighting equipment in connection with the 10-year street-lighting contract with the city of Indianapolis.

LEAVENWORTH, IND.—The Leavenworth El. Lt. Co., recently incorporated with a capital stock of $2,000, proposes to furnish electricity in Leavenworth and surrounding territory.

CHICAGO, ILL.—By action taken by the Trustees of the Sanitary District of Chicago the town of Cicero will be allowed to purchase the electric installations which the Sanitary District has installed there. This action is considered by a number of the trustees as the first of a series affecting outlying communities. In each of the outlying centers the Sanitary District will continue to provide the street-lighting service, giving up only the private contracts.

SPRINGFIELD, ILL.—The lower branch of the Illinois General Assembly has passed a bill appropriating $5,000 for new electric elevators in the Capitol; a fund of $9,000 is already available for this purpose. Another bill passed by the house carries an appropriation of $140,000 for the installation of a new lighting and heating plant in the State power plant in Springfield.

WHITE HALL, ILL.—At an election held recently the proposal to establish a municipal electric-lighting plant was carried.

BURNETT, WIS.—An electric-lighting system, it is reported, will be installed in the village of Burnett. Energy to operate the plant will be secured from Beaver Dam.

JANESVILLE, WIS.—Steps have been taken by the Janesville Commercial Club for the installation of an ornamental lighting system in the business district, for which it is understood plans have been prepared.

KESHENA, WIS.—The government sawmill, gristmill and electric-light plant on the Menominee Indian Reservation was recently destroyed by fire, causing a loss of $30,000.

LA CROSSE, WIS.—The Wisconsin Commission has instructed the Wisconsin & Minnesota Lt. & Pwr. Co. to enlarge the capacity of its distribution system and service installation for heating service in the city of La Crosse. In order further to improve its service the company is ordered to install at its own expense hydraulic thermostats, replacing the existing pneumatically operated ones.

OSHKOSH, WIS.—The Board of Public Works has been authorized to ask for bids for the installation of a generator and for connections for an independent electric-lighting system in the new high school.

SHAWANO, WIS.—Plans are being prepared by the Pwr. Engineering Co., of Minneapolis, Minn., for the construction of a municipal electric-light plant. When completed the proposal to install a municipal plant will be submitted to the voters. The plans provide for the erection of a plant on the Wolf River, 4 miles from Shawano, and the equipment will include two waterwheels of 500 hp each, two waterwheel governors (each capable of exerting 17,000 ft.-lb. of controlling effort), two 400-kva, three-phase, 60-cycle, 2300-volt (vertical-type) generators, switchboard equipment, etc.

ALBERT LEA, MINN.—Bids will be received at the office of Fred Tavis, county auditor of Freeborn County, Court House, Albert Lea, until June 1, for construction, including general contract work, jail cell work, heating and plumbing and electrical work, in accordance with plans and specifications prepared by Alden & Harris, architects, Commerce Building, St. Paul. Bids to be submitted separately.

EVELETH, MINN.—The Home El. & Htg. Co., of Eveleth, it is reported, has decided to make extensive improvements to its plant, including the installation of a new 350-kw and a 150-kw generating unit and a 300-hp water-tube boiler, a 600-hp feed-water heater, automatic coal conveyor, and construction of a new power station and also extensions to steam mains.

HENDRUM, MINN.—The proposal to issue $5,000 in bonds for the installation of an electric-lighting system will soon be submitted to the voters.

MANKATO, MINN.—The City Council on April 28 awarded a contract which provides for the installation of 61 additional ornamental lamp standards. Gas-filled tungsten lamps will be used and the energy will be supplied by the Consumers' Pwr. Co.

NEW LONDON, MINN.—F. O. Hillman, it is reported, is planning to install an electric-light plant in the mill at Spring Lake to supply electricity in the village of Spicer.

ST. PAUL, MINN.—The Consumers' Pwr. Co., of St. Paul, a subsidiary of the Northern States Pwr. Co., has secured the contract for furnishing electricity for lamps and motors and steam heating for the new Railroad Building, erected by James J. Hill. The contracts covers 850 hp in motors and 750 kw for lighting.

ST. PAUL, MINN.—Bids will be received by the State Board of Control, State Capitol, St. Paul, until June 1 for general construction, mechanical equipment and deep well of a tuberculosis sanatorium for the counties of Beltrami, Hubbard and Koochiching, in accordance with plans and specifications prepared by Sund & Dunham, architects, 514 Essex Building, Minneapolis, and Rose & Harris, engineers, Minneapolis.

TRACY, MINN.—Bids will be received until June 22 by Charles M. Campbell, city recorder, Campbell, for sale of municipal water and lighting plant. For details see proposal columns.

CHARTER OAK, IA.—Preparations are being made for the installation of an electric-lighting plant for which bonds have been sold.

JEWELL, IA.—The Henderson Lt. & Pwr. Co., of Jewell, expects to establish a day service in about 60 days, operating motors on 240 volts, single-phase, except when conditions call for three-phase service. The erection of a transmission line to Ellsworth, a distance of 3 miles, this summer is under consideration. M. Henderson is proprietor.

LAKE CITY, IA.—A special election will be held to vote on the proposal to grant the Central Iowa Lt. & Pwr. Co., of Boone, a franchise to supply electricity for lamps and motors in Lake City for a period of 25 years.

SPENCER, IA.—Within the next six months the Electric Light Commissioners expect to erect a three-phase, 13,200-volt transmission line to Ruthven and Dickens, Ia., and substations for same; also to purchase one 300-kva generating unit (directly connected). As yet nothing definite has been decided. C. A. Kutcher is superintendent.

WILTON JUNCTION, IA.—The City Council has rejected the proposal submitted by the Davenport & Muscatine Ry. Co., of Davenport, for the erection of a transmission line to Wilson. The city will install a new municipal plant. When completed an 18-hour service will be established.

CARUTHERSVILLE, MO.—Bids will be received by W. D. Byrd, Mayor of the city of Caruthersville, until June 2 for sewerage and water-works construction. The sewerage work consists of approximately 7 miles of 8-in. to 18-in. pipe, 4 ft. to 22 ft. deep, 81 manholes, 25 flush tanks, sewage-pumping station with motor-driven centrifugal pumps and Mississippi River outfall. Plans and specifications may be obtained from Frank L. Wilcox, engineer, Syndicate Trust Building, St. Louis, Mo., upon deposit of $25 for sewer plans and $15 for waterworks plans, to be refunded upon return of same.

GRANBY, MO.—The Ozark Pwr. & Wtr. Co., of Branson, operated by the Doherty Organization, 60 Wall Street, New York, N. Y., has been granted a 20-year franchise to supply electricity for lamps and motors in Granby. The company has a generating station on the White River.

SERGEANT BLUFF, MO.—The proposal

to issue $8,000 in bonds for the installation of a municipal electric-lighting plan will soon be submitted to the voters.

TROY, MO.—The City Council has voted to abandon the municipal electric generating station and has contracted with the Southern Illinois Lt. & Pwr. Co., of Hillsboro, Ill., for electricity to be distributed by the city.

TEKAMAH, NEB.—The question of issuing $15,000 in bonds for the installation of a municipal electric-light plant is under consideration.

ATCHISON, KAN.—The Illinois Trac. System, it is reported, is negotiating for a site for its proposed power plant, which is to furnish energy for the proposed high-tension transmission line to be erected from Atchison to Topeka. The cost of the plant is estimated at $200,000. R. F. Carley, of Peoria, Ill., is chief engineer.

MUSCOTAH, KAN.—Preliminary plans are being prepared for the installation of a municipal electric-lighting system.

Southern States

ASHEVILLE, N. C.—The North Carolina Electrical Pwr. Co., of Asheville, is contemplating the construction of an auxiliary steam-driven electric generating plant (to cost about $150,000) at the mouth of Beaverdam Creek, 4 miles from Asheville. The initial installation will provide for 4000 hp; the ultimate output of the plan will be 8000 hp. Contracts for equipment, it is understood, have been awarded. Samuel A. Johnson, of Asheville, superintendent, has charge of the work.

WAYNESVILLE, N. C.—At an election held recently bonds to the amount of $25,000 were voted for the installation of an electric light and power plant.

THOMASVILLE, GA.—The City Council is considering submitting to the voters the proposal to issue $30,000 in bonds for the installation of additional equipment in the municipal electric-light plant and extensions to water-works mains.

HOMESTEAD, FLA.—The installation of an electric-lighting plant in Homestead is under consideration.

NEW SMYRNA, FLA.—Bids will be received by the city of Smyrna until May 26 for furnishing all material and machinery for water-works and sewerage systems. The pumping plant will be driven by steam, oil engines or electric motors, for which bids are asked as follows: Steam plant—Two 80-hp boilers, steel-cased, one boiler-feed pump and heater, two 500-gal. per minute compound pumps, oil-burning equipment for two boilers, one 10,000-gal. horizontal-type steel fuel-oil tank. Oil engine plant—Two 500-gal. per minute triplex or duplex pumps driven by two 50-hp oil engines, burning either crude or distillate fuel oil; one 10,000-gal. fuel-oil tank, horizontal type. Electric-driven plant—Two 500-gal. per minute triplex pumps driven by two 50-hp, 2300-volt motors. Specifications may be obtained upon application to the J. B. McCrary Co., engineer, Third National Bank Building, Atlanta, Ga.

GLEASON, TENN.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric-lighting plant.

MILAN, TENN.—Bonds to the amount of $12,000 have been voted, the proceeds to be used for improvements to the water and light plant and to take up outstanding indebtedness. The plans provide for changing the municipal electric plant from direct-current to alternating-current system.

PLAINVIEW, ARK.—The City Council has granted W. W. Winters a franchise to construct and operate an electric-lighting plant in Plainview. The Council has also entered into a contract with Mr. Winters for lighting the streets of the city.

LENZBURG, LA. (not a post office).—Walter Buell and J. M. Doll, of Shreveport, who are installing an electric-lighting plant in Crichton, are planning to erect a power station in Lenzburg, both in the Red River oil field, at a total cost of $20,000. The Cahn El. Co., of Shreveport, has been awarded the contract.

ADAMSON, OKLA.—The Adamson Lt. & Pwr. Co., recently incorporated by J. R. Williams and others, is contemplating the installation of an electric-light plant in Adamson, to cost about $3,000.

HANNA, OKLA.—The installation of an electric light and power plant in Hanna is under consideration. A. A. Sing is reported interested.

MANGUM, OKLA.—Bonds to the amount of $75,000 have been issued for the installation of a municipal electric-light plant in Mangum.

DEL RIO, TEX.—The property of the City Ice & El. Co., of Del Rio, it is reported, has been purchased by the Southern El. Co., for $90,000. The new owners, it is understood, will make improvements to the system.

HOUSTON HEIGHTS, TEX.—The Houston Ltg. & Pwr. Co., of Houston, expects to complete within the next three months 25 miles of transmission lines. D. A. Hegarty is president and general manager.

McGREGOR, TEX.—The Texas Pwr. & Lt. Co., of Dallas, has purchased the property of the McGregor Wtr. & Lt. Co., and will erect a transmission line from Waco via Eddy and Moody to connect the McGregor plant with its transmission system. Improvements, it is understood, will be made to the local plant.

MARLIN, TEX.—The installation of a municipal electric-light plant in connection with the water-works system is under consideration by the Marlin public improvement and water-works committee.

MARLIN, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 14 for construction, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Marlin. Drawings and specifications may be obtained at the above office or from the custodian of site at Marlin.

MERKEL, TEX.—Negotiations are under way between the Abilene Gas & El. Co., of Abilene, and the Merkel El. Co., whereby the former will take over the property of the latter. If the deal is consummated, work will begin at once on the extension of the transmission lines to Merkel.

SLATON, TEX.—The Malone Lt. & Pwr. Co., of Plainview, is contemplating the installation of an electric-lighting system in Slaton.

Pacific States

FRIDAY HARBOR, WASH.—Application has been made to the Town Council by R. D. Berghardt, of Seattle, for a franchise to construct and operate an electric light and power plant in Friday Harbor.

OLYMPIA, WASH.—Three applications for franchises to construct and operate an electric lighting and power system in the city of Olympia have been presented to the City Council as follows: William W. Manier and associates, of Olympia; Scott C. Calhoun, Alaska Building, Seattle, and George H. Tilden, Hoge Building, Seattle.

PORT TOWNSEND, WASH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 24, for an oil-burning plant for heating boilers in the United States Marine Hospital at Port Townsend. For details see proposal columns.

SEATTLE, WASH.—Bids will be received at the office of the Board of County Commissioners of King County, Seattle, until June 1 for furnishing and installing electric passenger elevators of the "drum" and "traction" type. Bidders must submit bids for furnishing four, six and eight elevators, separately, all of said elevators to be installed in the new King County Court House, Seattle. Plans and specifications may be obtained at the office of A. Warren Gould, architect, American Bank Building, Seattle, Wash., upon deposit of $10.

GRESHAM, ORE.—Preparations are being made by the city of Gresham to secure water rights near Sandy, with a view of installing a municipal power plant. Application will be filed at once on water needed, and, according to report, a flume about 1,000 ft. long will be built. Preliminary surveys have been made by H. J. Stocker, who estimates the cost of the plant at about $100,000.

ONTARIO, ORE.—The Dead Ox Flat Irrigation Co., which owns power rights on the Fayette River, has applied to the City Council for a franchise to supply electricity in Ontario.

PORTLAND, ORE.—A permit has been granted by John H. Lewis, state engineer, to the city of Portland, to appropriate 500 second-ft. of water of the Sandy River and Zigzag Creek for the development of 20,000 hp. The water is to be diverted by means of a power canal 5½ miles long and is to be used for electric lighting and municipal purposes.

HUGHSON, CAL.—The Board of Trade is considering the question of establishing a lighting district in Hughson.

LOS ANGELES, CAL.—The Public Service Commissioners have adopted a resolution requesting the City Council to appropriate immediately not less than $100,000 to permit the beginning of the work on the Long Valley dam and the power plant at the Owens River gorge.

LOYALTON, CAL.—The Town Council is contemplating the installation of a municipal electric-light plant (to be driven by water-power) to take the place of the plant of the Loyalton El. Lt. Co., which is to close down soon.

WESTVILLE, CAL.—Plans are being prepared, it is reported, by the Herman Mine Co. for the installation of an electric plant this spring.

BOISE, IDAHO.—Definite plans have been made by the Municipal Ownership Club (A. W. Kool, president) for establishing a municipal electric-lighting plant for Boise. The city, it is stated, could secure the plant at the diversion dam from the United States government and develop additional power at Arrowrock.

LOGAN, UTAH.—The state engineer has approved the application of the Logan Mutual Pwr. Co., of Logan, for 125 second-ft. of water from Logan River at the head of the canyon. The water is to be carried in a flume 15,840 ft. long and a pipe 24,160 ft. long, a distance of about 8 miles. About 6800 hp will be developed. C. W. Hansen is manager.

PRICE, UTAH.—Application has been filed in the office of W. D. Beers, state engineer, by J. H. Manson, of Price, for appropriation of 250 second-ft. of the flow of the Price River, to be diverted through a canal 9348 ft. long and returned to the natural course after use for power purposes. Energy generated at the proposed plant will be supplied to towns and cities in Carbon and Price Counties.

SALT LAKE CITY, UTAH.—Appropriations of approximately $1,000,000 have been approved by the directors of the Utah Pwr. & Lt. Co., of Salt Lake City, for extensions and improvements to its system. A liberal amount, it is understood, is provided for the new street-lighting system in Salt Lake City. A large portion will be used for rebuilding portions of the present system and completing work already under way.

FLORENCE, ARIZ.—J. W. McCann and C. M. Shannon, of Florence, have submitted a proposition to the state engineer advocating the erection at once of a transmission line from Sacaton to Florence, a distance of 20 miles, for the purpose of supplying electricity for lamps and motors in Florence and for operating pumps for irrigating purposes to farmers along the line and also to supply energy to the prison farm.

POLSON, MONT.—J. H. Cline, it is reported, is contemplating the installation of an electric-light plant in Polson.

CODY, WYO.—The City Council, it is reported, has engaged the Billings Engineering Co., of Billings, Mont., to prepare plans for a municipal electric-lighting plant and water-works system. B. W. Bennett is city clerk.

BATTLE MOUNTAIN, NEV.—Preparations, it is reported, are being made by the Lander El. Lt. & Pwr. Co., of Lander, for the construction of a power station west of Battle Mountain.

Canada

VANCOUVER, B. C.—The capital stock of the Western Canada Pwr. Co., of Vancouver, has been increased from $5,000,000 to $10,000,000.

VANCOUVER, B. C.—Extensive improvements and extensions will be made by the British Columbia Tel. Co. to its lines in Vancouver, North Vancouver and the Nanaimo districts, involving an expenditure of about $70,000.

WINNIPEG, MAN.—Tenders will be received by the city of Winnipeg until June 5 for furnishing and installing one 150-kw motor-generating exciter set in the municipal generating station at Point du Bois. Specifications may be obtained at the office of the City Light and Power Department, 54 King Street, Winnipeg.

BLENHEIM, ONT.—The by-law authorizing the installation of hydroelectric power has been passed by the ratepayers.

PETERBOROUGH, ONT.—Bids will be received by S. R. Armstrong, secretary Peterborough Utilities Commission, Peterborough, until May 31 for furnishing and installing a complete pumping unit. Specifications may be received from the secretary. William Kennedy, Jr., 364 University Street, Montreal, Que., is engineer.

Miscellaneous

JUNEAU, ALASKA.—Extensive improvements are contemplated by the Ebner Gold Mining Co., of Juneau, for which an appropriation of $4,000,000 has been made. The proposed work will include the construction of an 8000-ton milling plant; construction of a large concrete dock; a hydroelectric plant, to cost about $1,000,000, and a 30,000-gal. oil-storage tank.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 11, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,138,625. Series Transformer; G. A. Burnham, Cliftondale, Mass. App. filed Feb. 8, 1911. Auxiliary closed circuited winding on cores keeps ratio of transformation constant.

1,138,632. Electric Regulation; J. L. Creveling, New York, N. Y. App. filed April 18, 1911. Regulating means operated electromagnetically.

1,138,637. System of Electrical Distribution; H. P. Davis, Pittsburgh, and F. Conrad, Swissvale, Pa. App. filed Dec. 31, 1908. For supplying power to feeder and trolley circuits of electric railways.

1,138,638. Locomotive; J. LeC. Davis, Pittsburgh, Pa. App. filed Jan. 10, 1908. Electric driving motors of compact design.

1,138,647. Safety Speed-Control Apparatus for Motors; S. H. Eckmann and J. Wagner, Manchester, England. App. filed May 11, 1912. Mine hoists.

1,138,652. Wireless Telegraphy; B. Graves, Thorntown, Ind. App. filed Jan. 24, 1914. Sensitive audion type of detector.

1,138,659. Resistance Device; S. E. Huenerfauth, Chicago, Ill. App. filed June 18, 1914. For electroplating tanks.

1,138,672. Dynamo-Electric Machine; B. G. Lamme, Pittsburgh, Pa. App. filed Sept. 10, 1909. Field-magnet structure.

1,138,673. Switching Device; B. G. Lamme and J. L. McK. Yardley, Pittsburgh, Pa. App. filed Oct. 31, 1913. For synchronous-booster rotary converters.

1,138,674. Process of Preparing Arc-Lamp Electrodes; G. M. Little, Pittsburgh, and B. J. Gudge, Wilkinsburg, Pa. App. filed April 21, 1910. Simultaneously bakes and axially rotates.

1,138,677. Electrically Operated Switch; W. O. Lum, Wilkinsburg, Pa. App. filed June 14, 1912. Operates only when energy supplied it falls within predetermined limits.

1,138,688. Self-Restoring Annunciator; A. C. Reid, Genoa, Ill. App. filed Aug. 18, 1913. For magneto multiple switchboards.

1,138,689. Synchronizing System; B. P. Rowe, Wilkinsburg, Pa. App. filed June 24, 1913. Automatically prevents connection of generator to busbars until proper electrical conditions are attained.

1,138,690. Meter; A. P. Rypinski, New York, N. Y. App. filed March 18, 1913. Attachment by which integrating meter may be transformed into indicating meter.

1,138,693. Trolley; W. Schaake, Pittsburgh, Pa. App. filed Dec. 24, 1909. Pantograph type.

1,138,698. Telephone; E. S. and C. D. Stewart, Ottawa, Ill. App. filed May 26, 1913. Combined transmitter and receiver for lineman's test telephone.

1,138,701. Overhead Electric-Line Construction; T. Varney, Pittsburgh, Pa. App. filed April 5, 1907. Particularly for catenary trolley line.

1,138,702. Electric-Line Support; T. Varney, Pittsburgh, Pa. App. filed Dec. 2, 1909. Skirt-tight insulator.

1,138,733. Electrical Heating Unit; L. G. Copeman, Flint, Mich. App. filed Jan. 23, 1914. For cooking.

1,138,734. Automatic-Telephone Responding Apparatus; E. J. Cressey, Wichita, Kan. App. filed Oct. 14, 1913. Phonograph responds to calls.

1,138,739. Composite Electric System; R. M. Eaton, Niagara Falls, N. Y. App. filed April 15, 1909. Telephone and police system.

1,138,746. Brush or Collector for Electrical Machines; E. Gindre, Paris, France. App. filed July 25, 1913. Special yoke structure for attachment to brush.

1,138,748. Track Relay for Signal Systems; G. B. Gray, Pittsburgh, Pa. App. filed Sept. 1, 1911. Compound relay for train-stopping systems.

1,138,752. Key-Operated Rotary Switch; M. Guett, Hartford, Conn. App. filed Jan. 16, 1912. Flush type.

1,138,754. Circuit Interrupter; F. W. Harris, Wilkinsburg, Pa. App. filed Sept. 26, 1910. Special tripping construction.

1,138,761. Electrolytic Interrupter; J. R. Kelly, Covington, Ky. App. filed March 19, 1912. Prevents heating, improvements in structure.

1,138,763. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed Aug. 3, 1912. Revoluble sleeve type.

1,138,785. Demand Indicator; W. E. Porter, Lynn, Mass. App. filed Aug. 1, 1913. Improved mechanical features of construction.

1,138,786. Demand Indicator; W. E. Porter, Lynn, Mass. App. filed July 1, 1914. Simple and compact construction.

1,138,787. Demand Apparatus; W. E. Porter, Lynn, Mass. App. filed Aug. 4, 1914. Has no interrupting gear connections.

1,138,800. Circuit-Breaker; W. M. Scott, Berwyn, Pa. App. filed Jan. 31, 1912. Has means preventing immediate actuation of the tripping action.

1,138,801. Horn-Blowing Attachment for Automobiles; W. W. Scott, Plant City, Fla. App. filed June 3, 1914. Operates switch to sound horn when turning corner.

1,138,808. Circuit Controller; L. L. Tatum, Milwaukee, Wis. App. filed June 13, 1913. Has advantageous features of both sliding and abutment contact controllers.

1,138,827. Third-Rail System; P. H. Zum Mallen, Chicago Heights, Ill. App. filed Aug. 15, 1914. Rail sections energized only when car approaches.

1,138,830. Printing-Telegraph Receiver; C. G. Ashley, Chicago, Ill. App. filed Nov. 21, 1910. Printing pens operated wholly by electromagnets.

1,138,832. Writing Machine; O. F. Bamberg and E. Weinhold, Laibach, Austria-Hungary. App. filed May 29, 1913. Connects together two typewriting machines for transmitting in cipher.

1,138,834. Direction Indicator for Vehicles; W. W. Bell, Alameda, Cal. App. filed March 16, 1914. Automatic and rendered inoperative when car engine stops.

1,138,841. Electric Sadiron; W. A. Braun, Canal Dover, Ohio. App. filed Oct. 12, 1912. Special means for adjusting heat and for automatically cutting off current.

1,138,853. Contactor; F. L. Eager, Waterbury, Conn. App. filed Oct. 14, 1909. For operating trolley-car signals.

1,138,857. Combined Switch and Fuse; R. Elsman, San Francisco, and C. Dallerup, San Rafael, Cal. App. filed Aug. 20, 1913. For polyphase lines.

1,138,874. Electric Switch; C. J. Klein, Milwaukee, Wis. App. filed April 18, 1914. Particularly for automobile motor starter.

1,138,879. Trunking System for Telephone Exchanges; F. R. McBerty, New Rochelle, N. Y. App. filed Sept. 8, 1909. Automatic or semi-automatic.

1,138,889. Magnetic Separator; D. L. Rand, Ayr, N. D. App. filed Jan. 16, 1915. For grain mills.

1,138,912. Dynamo-Electric Machine; M. E. Thompson, Ridgway, Pa. App. filed June 23, 1910. Alternator of rotating field type.

1,138,921. Process of Recovering Metals by Electrolysis; L. Addicks, Douglas, Ariz. App. filed Nov. 5, 1914. Electrolytic reduction of copper in the presence of an iron salt.

1,138,945. Perforating Apparatus for Making Register Bands; E. Ehrhardt, Berlin, Germany. App. filed Dec. 10, 1912. Typewriter keyboard construction.

1,138,958. Printing Telegraph; O. L. Kleber, Pittsburgh, Pa. App. filed March 24, 1911. Has rotary-type wheel. (Fifty-nine claims.)

1,138,959. Telephone Transmitter; D. Koenig, New York, N. Y. App. filed March 21, 1911. Improved construction for conducting away heat generated.

1,138,965. Trolley Mechanism; G. E. Lynch, Chelsea, Mass. App. filed June 24, 1907. Trolley needs not be reversed when direction of travel is changed.

1,138,979. Electrically Driven Clock; T. Rushton, Upper Holloway, London, Eng. App. filed June 13, 1912. Rounded intervals, by electromagnets.

1,138,988. Visual Signal Station; A. L. Sohm, Los Angeles, Cal. App. filed May 2, 1910. Watchman's signal box.

1,138,990. Electrical Circuit-Changing Mechanism; A. L. Sohm, Chicago, Ill. App. filed April 15, 1912. Step-by-step system for registering elapsed time.

1,138,991. Electrical Apparatus and Circuit; A. L. Sohm, Chicago, Ill. App. filed April 22, 1912. Means for intermittently closing circuit of secondary clock.

1,139,001. Electrical Water Heater; S. Le F. Varvel, Melbourne, Victoria, Australia. App. filed Nov. 18, 1914. Heating wire located in annular space.

1,139,005. Magnetic Clutch; A. W. Whitcomb, Worcester, Mass. App. filed May 22, 1911. Has frictional surfaces.

1,139,047. Drawbridge Circuit Controller; F. Marsellis, Berkeley, Cal. App. filed Nov. 12, 1912. Co-operating sets of contact fingers on drawbridge and abutment.

1,139,076. Resistance for Electric Heaters; E. A. Rutenber, Logansport, Ind. App. filed Jan. 31, 1914. Arrangement of heating coils on mica disk.

1,139,087. Electric Door Latch; T. S. Torresson, New York, N. Y. App. filed March 18, 1914. Rings alarm if attempt to open door is made.

1,139,121. Electrical Ignition System for Internal-Combustion Engines; G. Honold, Stuttgart, Germany. App. filed March 25, 1912. Has "service" ignition and "starting" ignition.

1,139,127. Composite Electric System; A. D. T. Libby, Elyria, Ohio. App. filed Jan. 28, 1910. Telephone and police system with signal for patrolman.

1,139,141. Locking Clip; L. Steinberger, Brooklyn, N. Y. App. filed Oct. 18, 1910. For supporting overhead trolley wires.

1,139,142. Locking Clip; L. Steinberger, Brooklyn, N. Y. App. filed Sept. 21, 1912. Can be detached from the hanger without detaching the hanger from the span wire.

1,139,152. Burglar-Alarm Lock; J. Baltes, New York, N. Y. App. filed Feb. 12, 1914. Forcing of bolt actuates alarm while proper operation of bolt does not.

1,139,155. Mail-Box Signal; A. R. Bennett, Knoxville, Tenn. App. filed Jan. 29, 1914. Mail in box rings alarm in house.

1,139,169. Demand Apparatus; J. T. Dempster, Schenectady, N. Y. App. filed Dec. 7, 1914. Records magnitude of maximum demand of an installation.

1,139,201. Direct-Current Dynamo Machine; W. Luyken, Essen-on-the-Ruhr, Germany. App. filed Dec. 5, 1910. Has alternating-current secondary winding on magnet frame.

1,139,203. Direct-Current Machine; C. W. Girvin, San Francisco, Cal. App. filed May 14, 1913. Relatively high potential.

1,139,210. Electric Engine Starter; M. P. Mitchell, Eaton, Ohio. App. filed March 14, 1914. Upon attaining speed motor is automatically clutched to engine.

1,139,213. Negative Pole Plate for Alkaline Storage Batteries; Des Moines, Ia. App. filed Aug. 6, 1913. Zinc and titanium.

1,139,214. Electrolyte for Secondary Batteries; W. Morrison, Des Moines, Ia. App. filed Sept. 11, 1914. Sulphuric-acid solution of titanic acid.

1,139,226. Radiotelegraphy; E. Raymond Barker, Wimbledon, Eng. App. filed Jan. 9, 1908. Signals made up of approximately equal time-value elements.

1,139,251. Automatic Time Check for Oil Presses and Other Machines; T. Bell, Tyler, Tex. App. filed Aug. 9, 1913. Shows working and idle periods of machine.

1,139,255. Dual Ignition System; A. P. Brush, Detroit, Mich. App. filed March 21, 1912. Special starting arrangement.

1,139,258. Signal Box; T. H. S. Cone, Bound Brook, N. J. App. filed Dec. 18, 1912. Wall-box type of fire alarm.

1,139,278. Electric Switch; G. H. Hart, West Hartford, Conn. App. filed Dec. 31, 1914. Push-button construction.

1,139,294. System of Distribution; J. L. Johnson, Milwaukee, Wis. App. filed June 27, 1910. Involves the storage of kinetic energy.

1,139,295. Circuit Closer for Electric-Lighted Levels or Plumbs; A. R. Jones, Bangor, Maine. App. filed Aug. 16, 1913. Contact slides light lamps for illuminating levels.

1,139,300. Electric Riveting Apparatus; F. P. Kobert, New Haven, Conn. App. filed Jan. 5, 1914. Embodies principles, construction and operation of modified power press.

1,139,389. Method of Operating an Electrolytic Cell; E. E. Werner, Indianapolis, Ind. App. filed Aug. 3, 1914. Uninterrupted operation of electrolytic cells at maximum capacity.

1,139,410. Apparatus for Detinning Tin Scrap, Boxes or the Like; H. Goldschmidt, Essen-on-the-Ruhr, Germany. App. filed Dec. 24, 1906. Chain of tin-containing baskets passes through alkaline bath.

1,139,413. Apparatus for Transmitting Sounds by Means of Hertzian Waves; W. Harrison, New York, N. Y. App. filed March 11, 1902. Gap is exposed to the action of sound-controlled ultra-violet light.

1,139,466. Demand Apparatus; L. T. Robinson and J. T. Dempster, Schenectady, N. Y. App. filed March 18, 1913. Records general normal demand and the abnormally large demands made by an electric installation upon central station.